C.3 – CULTURAL RESOURCES AND NATIVE AMERICAN VALUES

C.3.1 SUMMARY OF CONCLUSIONS

On the basis of a 25% sample of the cultural resources inventory of the project area of analysis, staff concludes that the Calico Solar Project (formerly known as the Stirling Energy Systems Solar One Project) would have significant impacts/effects on both prehistoric and historical surface archaeological resources. Furthermore, although the likelihood of encountering buried archaeological deposits is considered to be low, there is some potential that the project could also have significant impacts/effects on potentially historically significant buried archaeological deposits. As both the Bureau of Land Management (BLM) and the California Energy Commission (Energy Commission) have regulatory authority over the proposed project, the present analysis seeks to resolve the potentially significant effects of proposed and alternative actions on significant cultural resources through the development of measures that satisfy the common conceptual threads of effects resolution in the California Environmental Quality Act (CEQA), the National Environmental Policy Act (NEPA), and Section 106 of the National Historic Preservation Act. Energy Commission staff here proposes that the Energy Commission fulfill the bulk of its obligation under CEQA to resolve any potentially significant effects that the project may have on cultural resources by requiring the applicant to comply with the terms of the BLM's programmatic agreement (PA) under Section 106 a condition of certification (**CUL-1**). The BLM proposes to use this cultural resources analysis and its consultation efforts under Section 106, which includes the negotiation and drafting of the PA, to comply with NEPA. The applicant's implementation of the terms of the PA would ensure compliance with applicable laws, ordinances, regulations, and standards (LORS), in addition to compliance with CEQA, NEPA, and Section 106.

C.3.2 INTRODUCTION

This cultural resources assessment identifies the potential impacts of the Calico Solar Project on cultural resources. Cultural resources are defined under federal and state law as including archaeological sites, buildings, structures, objects, and districts. Three kinds of cultural resources, classified by their origins, are considered in this assessment: prehistoric, ethnographic, and historic.

Prehistoric archaeological resources are associated with the human occupation and use of California prior to enforced European contact. These resources may include sites and deposits, structures, artifacts, rock art, trails, and other traces of Native American human behavior. In California, the prehistoric period began over 12,000 years ago and extended through the eighteenth century until 1769, when the first Europeans settled in California.

Ethnographic resources represent the heritage of a particular ethnic or cultural group, such as Native Americans or African, European, or Asian immigrants. Ethnographic resources may include traditional resource collecting areas, ceremonial sites, topographic features, cemeteries, shrines, or ethnic neighborhoods and structures.

Historic-period resources, both archaeological and architectural, are associated with Euro-American exploration and settlement of an area and the beginning of a written historical record. They may include archaeological deposits, sites, structures, traveled ways, artifacts, or other evidence of human activity. Under federal and state historic preservation law, historic-period cultural resources must, under most circumstances, be at least 50 years old to have the potential to be of sufficient historical importance to merit eligibility for the National Register of Historic Places and the California Register of Historical Resources. A resource less than 50 years of age must be of exceptional historical importance to be considered for the National Register of Historic Places.

Groupings of historic-period resources are also recognized as historic districts and as historic vernacular landscapes. Under federal and state laws, historic cultural resources must be greater than fifty years old to be considered of potential historic importance. A resource less than fifty years of age may be historically important if the resource is of exceptional importance in history.

For the Calico Solar Project, staff provides an overview of the environmental setting and history of the project area, a representative sample of the inventory of the cultural resources identified in the project area for the proposed action and the nearby vicinity, and an analysis of the potential impacts to cultural resources from the proposed project using criteria from the National Environmental Policy Act (NEPA), Section 106 and the California Environmental Quality Act (CEQA).

C.3.3 METHODOLOGY AND THRESHOLDS FOR DETERMINING ENVIRONMENTAL CONSEQUENCES

The purpose of the present cultural resources analysis is to provide evidence of the ongoing public process by which the Energy Commission and the Bureau of Land Management (BLM) are jointly complying with local, State, and Federal regulations to which each agency is variously subject. The Energy Commission, pursuant to subdivision (c) of section 25519 of the Warren-Alquist Act (Pub. Resources Code section 25000 et seq.) of 1974 (Act), is the lead agency under CEQA in certifying the proposed facility and the site on which the facility would operate, and is further responsible, pursuant to section 25525 of the Act, for making findings regarding the facility's would conformity with applicable State, local, or regional standards, ordinances, or laws. The BLM is the lead agency for the purpose of complying with NEPA, as the Federal government considers the environmental implications of the proposed action, and has further obligations to comply with Section 106 of the National Historic Preservation Act of 1966, as amended (16 USC 470(f)) (NHPA), and other Federal historic preservation programs.

The structure of the cultural resources analysis for the proposed action accommodates both the primary need of the Energy Commission to evaluate potential impacts to cultural resources under CEQA and the primary needs of the BLM to conduct similar analyses under NEPA and Section 106. (Each of these three regulatory programs uses slightly different terminology to refer to the proposed action. Clarifications on the use of "proposed action," "proposed project," and "undertaking" may be found in the "Cultural Resources Glossary" subsection, below.) This analysis fulfills the goals of the three regulatory programs by executing five basic analytic phases. The initial phase is the determination of the appropriate geographic extent of the analysis for the proposed action and for each alternative action under consideration. The second phase is to produce an inventory of the cultural resources in each such geographic area. The third phase is to determine whether particular cultural resources in an inventory are historically significant, unless resources can be avoided by construction. The fourth phase is to assess the character and the severity of the effects of the proposed or alternative actions on the historically significant cultural resources that cannot be avoided in each respective inventory. The final phase is to propose measures that would resolve significant effects. The details of each of these phases follow below and provide the parameters of the present analysis.

C.3.3.1 THE PROJECT AREA OF ANALYSIS AND THE AREA OF POTENTIAL EFFECTS (APE)

A useful precursor to a cultural resources analysis under CEQA and NEPA and a requisite part of the Section 106 process (36 CFR Part 800) is to define the appropriate geographic limits for an analysis. The area that Energy Commission staff typically considers when identifying and assessing impacts to cultural resources under CEQA is referred to here as the "project area of analysis." Energy Commission staff defines the project area of analysis as the area within and surrounding a project site and associated linear facility corridors. The area reflects the minimum standards set out in the Energy Commission Power Plant Site Certification Regulations (Cal. Code Regs., tit. 20, § 1701 et seq., appen. B, subd. (g)(2)) and is sufficiently large and comprehensive in geographic area to facilitate and encompass considerations of archaeological, ethnographic, and built-environment resources. The project area of analysis is a composite, though not necessarily contiguous geographic area that accommodates the analysis of each of these resource types:

- For archaeological resources, the project area of analysis is minimally defined as the project site footprint, plus a buffer of 200 feet, and the project linear facilities routes, plus a buffer of 50 feet to either side of the rights-of way for these routes.
- For ethnographic resources, the project area of analysis is expanded to take into account traditional use areas and traditional cultural properties which may be far-ranging, including views that contribute to the significance of the property. These resources are often identified in consultation with Native Americans and other ethnic groups, and issues that are raised by these groups may define the area of analysis.
- For built-environment resources, the project area of analysis is confined to one parcel deep from the project site footprint in urban areas, but in rural areas is expanded to include a half-mile buffer from the project site and above-ground linear facilities to encompass resources whose setting could be adversely affected by industrial development.
- For a historic district or a cultural landscape, staff defines the project area of analysis based on the particulars of each siting case (i.e., specific to that project).

The BLM concludes here that the project area of analysis concept provides an appropriate areal scope for the consideration of cultural resources under NEPA and is consistent with the definition of the area of potential effects (APE) in the Section 106 process (36

CFR § 800.16(d)). The project area of analysis will, therefore, be equivalent to the APE for the purpose of the present discussion and analysis.

C.3.3.2 INVENTORY OF CULTURAL RESOURCES IN PROJECT AREA OF ANALYSIS

A cultural resources inventory specific to each proposed or alternative action under consideration is a necessary step in the staff effort to determine whether each such action may cause, under CEQA, a substantial adverse change in the significance of any cultural resources that are on or would qualify for the California Register of Historical Resources (CRHR), may, under NEPA, significantly affect important historic and cultural aspects of our national heritage, or may, under Section 106, adversely affect any cultural resources that are on or would qualify for the National Register of Historic Places (NRHP).

The development of a cultural resources inventory entails working through a sequence of investigatory phases to establish the universe of cultural resources that will be the focus of the analyses of each proposed or alternative action. Generally the research process proceeds from the known to the unknown. These phases typically involve doing background research to identify known cultural resources, conducting fieldwork to collect requisite primary data on not-yet-identified cultural resources in the vicinity of an action, and assessing the results of any geotechnical studies or environmental assessments completed for a project site. The results of this research then support the development of determinations of historical significance for the cultural resources that are found.

C.3.3.3 DETERMINING THE HISTORICAL SIGNIFICANCE OF CULTURAL RESOURCES

A key part of a cultural resources analysis under CEQA, NEPA, or Section 106 is to determine which of the cultural resources that a proposed or alternative action may affect, are important or historically significant (each of these three regulatory programs uses slightly different terminology to refer to historically significant cultural resources; clarifications on the use of the terms "*historical resource*," "*important historic and cultural aspects of our national heritage*," and "*historic property*" may be found in the "Cultural Resources Glossary" subsection, of this report). Subsequent effects assessments are only made for those cultural resources that are determined to be historically significant. Cultural resources that can be avoided by construction may remain unevaluated. Unevaluated cultural resources that cannot be avoided are treated as eligible when determining effects. The criteria for evaluation and the requisite thresholds of resource integrity that are, taken together, the measures of historical significance, vary among the three regulatory programs.

Evaluation of Historical Significance under CEQA

CEQA requires the Energy Commission, as a lead agency, to evaluate the historical significance of cultural resources by determining whether or not they meet several sets of specified criteria. Under CEQA, the definition of a historically significant cultural resource is that it is eligible for listing in the CRHR, and such a cultural resource is referred to as a "historical resource," which is a "resource listed in, or determined to be eligible by the State Historical Resources Commission, for listing in the CRHR", or "a resource listed in a local register of historical resources or identified as significant in a historical resource survey meeting the requirements of section 5024.1(g) of the Public Resources Code," or "any object, building, structure, site, area, place, record, or manuscript which a lead agency determines to be historically significant or significant in the architectural, engineering, scientific, economic, agricultural, educational, social, political, military, or cultural annals of California, provided the agency's determination is supported by substantial evidence in light of the whole record" (Cal. Code Regs., tit. 14, § 15064.5(a)). The term, "historical resource," therefore, indicates a cultural resource that is historically significant and eligible for listing in the CRHR.

Consequently, under the CEQA Guidelines, to be historically significant, a cultural resource must meet the criteria for listing in the CRHR. These criteria are essentially the same as the eligibility criteria for the NRHP. In addition to being at least 50 years old,[1] a resource must meet at least one (and may meet more than one) of the following four criteria (Pub. Resources Code, § 5024.1):

- Criterion 1, is associated with events that have made a significant contribution to the broad patterns of our history;
- Criterion 2, is associated with the lives of persons significant in our past;
- Criterion 3, embodies the distinctive characteristics of a type, period, or method of construction, or represents the work of a master, or possesses high artistic values; or
- Criterion 4, has yielded, or may be likely to yield, information important to history or prehistory.

In addition, historical resources must also possess integrity of location, design, setting, materials, workmanship, feeling, and association (Cal. Code Regs., tit. 14, § 4852(c)).

Additionally, cultural resources listed in or formally determined eligible for the National Register of Historical Places (NRHP) and California Registered Historical Landmarks numbered No. 770 and up are automatically listed in the CRHR and are therefore also historical resources (Pub. Resources Code, § 5024.1(d)). Even if a cultural resource is not listed or determined to be eligible for listing in the CRHR, CEQA allows a lead agency to make a determination as to whether it is a historical resource (Pub. Resources Code, § 21084.1).

Evaluation of Historical Significance under NEPA

NEPA establishes national policy for the protection and enhancement of the environment. Part of the function of the Federal Government in protecting the environment is to "preserve important historic, cultural, and natural aspects of our national heritage." Cultural resources need not be determined eligible for the National Register of Historic Places as in the National Historic Preservation Act (NHPA) of 1966 (as amended) to receive consideration under NEPA. NEPA is implemented by regulations of the Council

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[1] The Office of Historic Preservation's Instructions for Recording Historical Resources (1995) endorses recording and evaluating resources over 45 years of age to accommodate a potential five-year lag in the planning process.

on Environmental Quality, 40 CFR 1500-1508. NEPA provides for public participation in the consideration of cultural resources issues, among others, during agency decision-making.

Evaluation of Historical Significance under Section 106 (Eligibility of Cultural Resources for Inclusion in the NRHP)

The federal government has developed laws and regulations designed to protect cultural resources that may be affected by actions undertaken, regulated, or funded by federal agencies. Cultural resources are considered during federal undertakings chiefly under Section 106 of NHPA of 1966 (as amended) through one of its implementing regulations, 36 Code of Federal Regulations (CFR) CFR 800 (Protection of Historic Properties). Properties of traditional religious and cultural importance to Native Americans are considered under Section 101(d)(6)(A) of NHPA.

Section 106 of NHPA (16 United States Code [USC] 470f) requires federal agencies to consider the effects of their undertakings on any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register of Historic Places (NRHP) and to afford the Advisory Council on Historic Preservation (ACHP) a reasonable opportunity to comment on such undertakings (36 CFR Part 800.1). Under Section 106, the significance of any adversely affected cultural resource is assessed and mitigation measures are proposed resolve effects. Significant cultural resources (historic properties) are those resources that are listed in or are eligible for listing on the NRHP per the criteria listed at 36 CFR 60.4 (Advisory Council on Historic Preservation 2000) and are presented in the next subsection below.

NHPA of 1966 established the ACHP and State Historic Preservation Officers (SHPO) to assist federal and State officials regarding matters related to historic preservation. As previously mentioned above, the administering agency, the ACHP, has authored regulations implementing Section 106 that are located in 36 CFR Part 800, *Protection of Historic Properties* (recently revised, effective January 11, 2001). 36 CFR Part 800 provides detailed procedures, called the Section 106 process, by which the assessment of impacts on archaeological and historical resources, as required by the Act, is implemented.

Given that the proposed Calico Solar Project is located on lands managed by BLM and requires authorization by the BLM, the proposed action is considered an undertaking, and therefore must comply with the NHPA and implementing regulations. NEPA addresses compliance with the NHPA, and the required environmental documentation, whether it is an Environmental Assessment (EA) or an Environmental Impact Statement (EIS), must discuss cultural resources. It is important to recognize, however, that project compliance with NEPA does not mean the project is in compliance with the NHPA.

According to the NHPA (36 CFR Part 800), three steps are required for compliance: (1) identification of significant resources that may be affected by an undertaking; (2) assessment of project impacts on those resources; and (3) development and implementation of mitigation measures to offset or eliminate adverse impacts. All three steps require consultation with interested Native American tribes, local governments, and other interested parties.

Identification and National Register of Historic Places Evaluation

36 CFR Part 800.3 discusses the consultation process. Section 800.4 sets out the steps the ACHP must follow to identify historic properties. 36 CFR Part 800.4(c)(1) outlines the process for National Register of Historic Places (NRHP) eligibility determinations.

The Historic Sites, Buildings and Antiquities Act of 1935 required the survey, documentation, and maintenance of historic and archaeological sites in an effort to determine which resources commemorate and illustrate the history and prehistory of the United States. The NHPA expanded on this legislation and assigned the responsibility for carrying out this policy to the United States Department of the Interior, National Park Service (NPS). Per NPS regulations, 36 CFR Part 60.4, and guidance published by the NPS, *National Register Bulletin, Number 15, How to Apply the National Register Criteria for Evaluation*, different types of values embodied in districts, sites, buildings, structures, and objects are recognized. These values fall into the following categories:

1. Associate Value (Criteria A and B): Properties significant for their association with or linkage to events (Criterion A) or persons (Criterion B) important in the past.

2. Design or Construction Value (Criterion C): Properties significant as representatives of the man-made expression of culture or technology.

3. Information Value (Criterion D): Properties significant for their ability to yield important information about prehistory or history.

The quality of *significance* in American history, architecture, archaeology, engineering and culture is present in districts, sites, buildings, structures, and objects that possess *integrity* of location, design, setting, materials, workmanship, feeling and association. Cultural resources that are determined eligible for listing in the NRHP, along with SHPO concurrence, are termed “historic properties” under Section 106, and are afforded the same protection as sites listed in the NRHP.

C.3.3.4 ASSESSING ACTION EFFECTS

The core of a cultural resources analysis under CEQA, NEPA, or Section 106 is to assess the character of the effects that a proposed or alternative action may have on historically significant cultural resources. The analysis takes into account three primary types of potential effects which each of the three above regulatory programs defines and handles in slightly different ways. The three types of potential effects include direct, indirect, and cumulative effects. Once the character of each potential effect of a proposed or alternative action has been assessed, a further assessment is made as to whether each such effect is significant, relative to specific regulatory criteria under CEQA, NEPA, and Section 106.

Direct and Indirect Effects

Direct and indirect effects are those that are more clearly and immediately attributable to the implementation of proposed or alternative actions. Direct and indirect effects are conceptually similar under CEQA and NEPA. The uses of the concepts vary under Section 106 relative to their uses under CEQA and NEPA as discussed below.

Direct and Indirect Impacts under CEQA

In the abstract, direct impacts to cultural resources are those associated with project development, construction, and co-existence. Construction usually entails surface and subsurface disturbance of the ground, and direct impacts to archaeological resources may result from the immediate disturbance of the deposits, whether from vegetation removal, vehicle travel over the surface, earth-moving activities, excavation, or demolition of overlying structures. Construction can have direct impacts on historic built-environment resources when those structures must be removed to make way for new structures or when the vibrations of construction impair the stability of historic structures nearby. New structures can have direct impacts on historic structures when the new structures are stylistically incompatible with their neighbors and the setting, and when the new structures produce something harmful to the materials or structural integrity of the historic structures, such as emissions or vibrations.

Generally speaking, indirect impacts to archaeological resources are those which may result from increased erosion due to site clearance and preparation, or from inadvertent damage or outright vandalism to exposed resource components due to improved accessibility. Similarly, historic structures can suffer indirect impacts when project construction creates improved accessibility and vandalism or greater weather exposure becomes possible.

Ground disturbance accompanying construction at a proposed Calico Solar Project site, along proposed linear facilities, and at a proposed laydown area has the potential to directly impact archaeological resources, unidentified at this time. The potential direct, physical impacts of the proposed construction on unknown archaeological resources are commensurate with the extent of ground disturbance entailed in the particular mode of construction. This varies with each component of the proposed project. Placing the proposed plant into this particular setting could have a direct impact on the integrity of association, setting, and feeling of nearby standing historic structures.

Direct and Indirect Effects under NEPA

The concepts of direct and indirect effects under NEPA are almost equivalent to those under CEQA. Direct effects under NEPA are those “which are caused by the [proposed or alternative] action and [which] occur at the same time and place” (40 CFR § 1508.8(a)). Indirect effects are those “which are caused by the [proposed or alternative] action and are later in time or farther removed in distance, but are still reasonably foreseeable” (40 CFR § 1508.8(b)).

Direct and Indirect Effects under Section 106

The Section 106 regulation narrows the range of direct effects and broadens the range of indirect effects relative to the definitions of the same terms under CEQA and NEPA. The regulatory definition of “effect,” pursuant to 36 CFR § 800.16(i), is that the term “means alteration to the characteristics of a historic property qualifying it for inclusion in or eligibility for the National Register.” In practice, a “direct effect” under Section 106 is limited to the direct physical disturbance of a historic property. Effects that are immediate but not physical in character, such as visual intrusion, and reasonably foreseeable effects that may occur at some point subsequent to the implementation of the proposed undertaking are referred to in the Section 106 process as “indirect effects.”

Cumulative Impacts

Cumulative Impacts are slightly different concepts under CEQA and NEPA, and are, under Section 106, undifferentiated as an aspect of the potential effects of an undertaking, of a proposed or alternative action. The consideration of cumulative impacts reaches beyond the project area of analysis or the area of potential effects. It is a consideration of how the effects of a proposed or alternative action in those areas contributes or does not contribute to the degradation of a resource group or groups that is or are common to the project area of analysis and the surrounding area or vicinity.

Cumulative Impacts under CEQA

A cumulative impact under CEQA refers to a proposed project's incremental effects considered over time and taken together with those of other, nearby, past, present, and reasonably foreseeable future projects whose impacts may compound or increase the incremental effect of the proposed project (Pub. Resources Code sec. 21083; Cal. Code Regs., tit. 14, secs. 15064(h), 15065(a)(3), 15130, and 15355). Cumulative impacts to cultural resources in a project vicinity could occur if any other existing or proposed projects, in conjunction with the proposed project, had or would have impacts on cultural resources that, considered together, would be significant. The previous ground disturbance from prior projects and the ground disturbance related to the future construction of a proposed project and other proposed projects in the vicinity could have a cumulatively considerable effect on archaeological deposits, both prehistoric and historic. The alteration of the natural or cultural setting which could be caused by the construction and operation of a proposed project and other proposed projects in the vicinity could be cumulatively considerable, but may or may not be a significant impact to cultural resources.

Cumulative Impacts under NEPA

Under NEPA, a cumulative is the “impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time” (40 CFR § 1508.7). Cumulatively significant impacts are taken into consideration as an aspect of the intensity of a significant effect (40 CFR § 1508.27(b)(7).

Cumulative Effects under Section 106

The Section 106 regulation makes explicit reference to cumulative effects only in the context of a discussion of the criteria of adverse effect (36 CFR § 800.5(a)(1)). Cumulative effects are largely undifferentiated as an aspect of the potential effects of an undertaking. Such effects are enumerated and resolved in conjunction with the consideration of direct and indirect effects.

Assessing the Significance of Action Effects

Once the character of the effects that proposed or alternative actions may have on historically significant cultural resources has been determined, the severity of those effects needs to be assessed. CEQA, NEPA, and Section 106 each have different definitions and tests that factor into decisions about how severe, how significant the effects of particular actions may be.

Significant Impacts under CEQA

Under CEQA, “a project that may cause a substantial adverse change in the significance of an historical resource is a project that may have a significant effect on the environment” (Pub. Resourced Code, § 21084.1). Thus, staff analyzes whether a proposed project would cause a substantial adverse change in the significance, that is, the CRHR eligibility, of the subset of the historical resources in the cultural resources inventory for a project area that the proposed project demonstrably has the potential to effect. The degree of significance of an impact depends on:

- The cultural resource impacted;
- The nature of the resource’s historical significance;
- How the resource’s historical significance is manifested physically and perceptually;
- Appraisals of those aspects of the resource’s integrity that figure importantly in the manifestation of the resource’s historical significance; and how much the impact will change those integrity appraisals.

Significant Effects under NEPA

Significant effects under NEPA require considerations of both context and intensity (40 CFR § 1508.27), and the considerations are presented below:

(a) *Context.* This means that the significance of an action must be analyzed in several contexts such as society as a whole (human, national), the affected region, the affected interests, and the locality. Significance varies with the setting of the proposed action. For instance, in the case of a site-specific action, significance would usually depend upon the effects in the locale rather than in the world as a whole. Both short- and long-term effects are relevant.

(b) *Intensity.* This refers to the severity of impact. Responsible officials must bear in mind that more than one agency may make decisions about partial aspects of a major action. The following should be considered in evaluating intensity:

> (1) Impacts that may be both beneficial and adverse. A significant effect may exist even if the Federal agency believes that on balance the effect will be beneficial.
>
> (2) Unique characteristics of the geographic area such as proximity to historic or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas.
>
> (3) The degree to which the action may establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration.
>
> (4) Whether the action is related to other actions with individually insignificant but cumulatively significant impacts. Significance exists if it is reasonable to anticipate a cumulatively significant impact on the environment. Significance cannot be avoided by terming an action temporary or by breaking it down into small component parts.

(5) The degree to which the action may adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural, or historical resources.

(6) Whether the action threatens a violation of Federal, State, or local law or requirements imposed for the protection of the environment.

Adverse Effects under Section 106

In accordance with 36 CFR Part 800.5 of the ACHP's implementing regulations, which describes criteria for adverse effects, impacts on cultural resources are considered significant if one or more of the following conditions would result from implementation of the proposed action:

An undertaking has an effect on a historic property when the undertaking may alter characteristics of the property that may qualify the property for inclusion in the NRHP. For the purpose of determining the type of effect, alteration to features of a property's location, setting, or use may be relevant, depending on the property's significant characteristics, and should be considered.

An undertaking is considered to have an adverse effect when the effect on a historic property may diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Adverse effects on historic properties include, but are not limited to:

1. Physical destruction, damage, or alteration of all or part of the property
2. Isolation of the property from or alteration of the character of the property's setting when that character contributes to the property's qualification for the NRHP
3. Introduction of visual, audible, or atmospheric elements that are out of character with the property or that alter its setting
4. Neglect of the property, resulting in its deterioration or destruction
5. Transfer, lease, or sale of the property

Consideration shall be given to all qualifying characteristics of a historic property, including those that may have been identified subsequent to the original evaluation of the property's eligibility for the National Register. Adverse effects may include reasonably foreseeable effects caused by the undertaking that may occur later in time, be farther removed in distance or be cumulative. A formal effect finding under Section 106 relates to the proposed or alternative action as a whole rather than relating to individual resources.

C.3.3.5 RESOLVING SIGNIFICANT EFFECTS

The concluding phase in a cultural resources analysis, whether under CEQA, NEPA, or Section 106, is to resolve those effects of a proposed or alternative action that have been found to be significant or adverse. The terminology used to describe the process of effects resolution differs among the three regulatory programs. The resolution of significant effects under CEQA involves the development of mitigation measures or project alternatives the implementation of which would minimize any such effects (14 CCR § 15126.4). Mitigation under NEPA includes proposals that avoid or minimize any potential significant effects of a proposed or alternative action on the quality of the human environment (40 CFR § 1502.4). The definition of mitigation in the NEPA regulation includes the development of measures that would avoid, minimize, or rectify significant effects, progressively reduce or eliminate such effects over time, or provide compensation for such effects (40 CFR § 1508.20). The Section 106 process directs the resolution of adverse effects through the development of proposals to avoid, minimize, or otherwise mitigate such effects (36 CFR § 800.6(a)).

The present analysis seeks to resolve the potentially significant effects of proposed and alternative actions on significant cultural resources (i.e., historical resources/historic properties) through the development of measures that satisfy the common conceptual threads of effects resolution in CEQA, NEPA, and Section 106. Energy Commission staff here proposes that the Energy Commission fulfill the bulk of its obligation under CEQA to resolve any potentially significant effects by requiring the applicant to comply with the terms of the BLM's programmatic agreement (PA) under Section 106 (**CUL-1**). The BLM proposes to use this cultural resources analysis and its consultation efforts under Section 106, which includes the negotiation and drafting of the PA, to comply with NEPA. The applicant's implementation of the terms of the PA would ensure compliance with applicable laws, ordinances, regulations, and standards (LORS), in addition to compliance with CEQA, NEPA, and Section 106.

Programmatic Agreement (PA)

In accordance with 36 CFR Part 800.14(b), PAs are used for the resolution of adverse effects for complex project situations and when effects on historic properties (resources eligible for or listed in the NRHP) cannot be fully determined prior to approval of an undertaking.

As a result of the anticipated impacts of the Calico Solar Project on cultural resources and the large geographic area comprising the APE, the BLM will prepare a PA in consultation with the Advisory Council on Historic Preservation (ACHP), State Historic preservation Officer (SHPO), the Energy Commission, and interested Native American tribes. The PA will govern the continued identification and evaluation of historic properties (eligible for the NRHP) and historical resources (eligible for the California Register), as well as the resolution of any adverse effects that may result from this proposed undertaking. When the PA is fully executed, the project will have fulfilled the requirements of the NHPA, NEPA, and CEQA.

The BLM initiated formal consultation with the SHPO and notified and initiated formal consultation with the Advisory Council on Historic Preservation (ACHP) by letter on February 16, 2010, including the development of a PA for the Calico Solar Project. A draft PA is currently in development and will be sent out to the Consulting Parties for their review and comment. Treatment plans regarding historic properties and historical resources that cannot be avoided by project construction will be developed in consultation with the Energy Commission, the SHPO, and interested Native American tribes, as stipulated in the PA. When the PA is fully executed the project will have fulfilled the requirements of the NHPA. The PA will be included in the Final EIS, and the Record of Decision will include the final signed PA.

C.3.3.6 LAWS, ORDINANCES, REGULATIONS, AND STANDARDS

Projects licensed by the Energy Commission are reviewed to ensure compliance with all applicable laws. Although the Energy Commission has pre-emptive authority over local laws, it typically ensures compliance with local laws, ordinances, regulations, standards, plans, and policies. The BLM is responsible for compliance with NEPA and Section 106 of the NHPA.

LORS applicable to the Calico Solar Project are in Cultural Resources Table 1 below.

Cultural Resources Table 1
Laws, Ordinances, Regulations, and Standards

Applicable Law	Description
Federal	
National Historic Preservation Act of 1966, as amended, 16 USC 470(f)	Section 106 of the Act requires Federal agencies to take into account the effects of a proposed action on cultural resources (historic properties) and afford the Advisory Council on Historic Preservation the opportunity to comment.
36 CFR Part 800 (as amended August 5, 2004),	Implementing regulations of Section 106 of the National Historic Preservation Act
National Environmental Policy Act (NEPA): Title 42, USC, section 4321-et seq.	This statute requires Federal agencies to consider potential environmental impacts of projects with Federal involvement and to consider appropriate mitigation measures.
Federal Land Policy and Management Act (FLPMA): Title 43, USC, section 1701 et seq.	This statute requires the Secretary of the Interior to retain and maintain public lands in a manner that will protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric water resource, and archaeological values [Section 1701(a)(8)]; the Secretary, with respect to the public lands, shall promulgate rules and regulations to carry out the purposes of this Act and of other laws applicable to public lands [Section 1740].
Federal Guidelines for Historic Preservation Projects, Federal Register 44739-44738, 190 (September 30, 1983)	The Secretary of the Interior has published a set of Standards and Guidelines for Archaeology and Historic Preservation. These are considered to be the appropriate professional methods and techniques for the preservation of archaeological and historic properties. The Secretary's standards and guidelines are used by Federal agencies, such as the Forest Service, the Bureau of Land Management, and the National Park Service. The California Office of Historic Preservation refers to these standards in its requirements for selection of qualified personnel and in the mitigation of potential impacts to cultural resources on public lands in California.
Executive Order 11593 May 13, 1971 (36 Federal Register 8921)	This order mandates the protection and enhancement of the cultural environment through providing leadership, establishing state offices of historic preservation, and developing criteria for assessing resource values.
American Indian Religious Freedom Act; Title 42, USC, Section 1996	Protects Native American religious practices, ethnic heritage sites, and land uses.

Applicable Law	Description
Native American Graves Protection and Repatriation Act (1990); Title 25, USC Section 3001, et seq.,	The stature defines "cultural items," "sacred objects," and "objects of cultural patrimony;" establishes an ownership hierarchy; provides for review; allows excavation of human remains, but stipulates return of the remains according to ownership; sets penalties; calls for inventories; and provides for the return of specified cultural items.
U.S. Dept. of the Interior, Bureau of Land Management (BLM), the California Desert Conservation Area (CDCA) Plan 1980 as amended – Cultural Resources Element Goals	1. Broaden the archaeological and historical knowledge of the CDCA through continuing efforts and the use of existing data. Continue the effort to identify the full array of the CDCA's cultural resources.
	2. Preserve and protect representative sample of the full array of the CDCA's cultural resources.
	3. Ensure that cultural resources are given full consideration in land use planning and management decisions, and ensure that BLM-authorized actions avoid inadvertent impacts.
	4. Ensure proper data recovery of significant (National Register of Historic Places-quality) cultural resources where adverse impacts can be avoided.
State	
California Environmental Quality Act (CEQA), Sections 21000 et seq. of the Public Resources Code (PRC) with Guidelines for implementation codified in the California Code of Regulations (CCR), Title 14, Chapter 3, Sections 15000 et seq.	CEQA requires that state and local public agencies to identify the environmental impacts of the proposed discretionary activities or projects, determine if the impacts will be significant, and identify alternatives and mitigation measures that will substantially reduce or eliminate significant impacts to the environment. Historical resources are considered a part of the environment and a project that may cause a substantial adverse effect on the significance of a historical resource is a project that may have a significant effect on the environment. The definition of "historical resources" is contained in Section 15064.5 of the CEQA Guidelines.
AB 4239, 1976	Established the Native American Heritage Commission (NAHC) as the primary government agency responsible for identifying and cataloging Native American cultural resources. The bill authorized the Commission to act in order to prevent damage to and insure Native American access to sacred sites and authorized the commission to prepare an inventory of Native American sacred sites located on public lands.
Public Resources Code 5097.97	No public agency, and no private party using or occupying public property, or operating on public property, under a public license, permit, grant, lease, or contract made on or after July 1, 1977, shall in any manner whatsoever interfere with the free expression or exercise of Native American religion as provided in the United States Constitution and the California Constitution; nor shall any such agency or party cause severe or irreparable damage to any Native American sanctified cemetery, place of worship, religious or ceremonial site, or sacred shrine located on public property, except on a clear and convincing showing that the public interest and necessity so require.

Applicable Law	Description
Public Resources Code 5097.98 (b) and (e)	Requires a landowner on whose property Native American human remains are found to limit further development activity in the vicinity until he/she confers with the Native American Heritage Commission-identified Most Likely Descendents (MLDs) to consider treatment options. In the absence of MLDs or of a treatment acceptable to all parties, the landowner is required to reinter the remains elsewhere on the property in a location not subject to further disturbance.
California Health and Safety Code, Section 7050.5	This code makes it a misdemeanor to disturb or remove human remains found outside a cemetery. This code also requires a project owner to halt construction if human remains are discovered and to contact the county coroner.
Local	
County of San Bernardino 2007 General Plan, C. Countywide Goals and Policies of the Conservation Element	GOAL CO 1. The County will maintain to the greatest extent possible natural resources that contribute to the quality of life within the County. GOAL CO 3. The County will preserve and promote its historic and prehistoric cultural heritage. POLICIES CO 3.1 Identify and protect important archaeological and historic cultural resources in areas of the County that have been determined to have known cultural resource sensitivity. CO 3.2 Identify and protect important archaeological and historic cultural resources in all lands that involves disturbance of previously undisturbed ground. CO 3.3 Establish programs to preserve the information and heritage value of cultural and historical resources. CO 3.4 The County will comply with Government Code Section 65352.2 (SB18) by consulting with tribes as identified by the California Native American Heritage Commission on all General Plan and specific plan actions. CO 3.5 Ensure that important cultural resources are avoided or minimized to protect Native American beliefs and traditions.
County of San Bernardino 2007 Development Code	82.12.010 Purpose (a) Many of the resources are unique and non-renewable; and (b) The preservation of cultural resources provides a greater knowledge of County history, thus promoting County identity and conserving historic and scientific amenities for the benefit of future generations. 82.12.040 Development Standards Archaeological and historical resources determined by qualified professionals to be extremely important should be preserved as open space or dedicated to a public institution when possible.

C.3.4 PROPOSED PROJECT

C.3.4.1 SETTING AND EXISTING CONDITIONS

Information provided regarding the setting of the proposed project places it in its geographical and geological context and specifies the technical description of the project. Additionally, the prehistoric, ethnographic, and historical background provides the context for the evaluation of the historical significance of any identified cultural resources within staff's area of analysis for this project.

Regional Setting

With minimal updates and editorial contributions, the following subsections entitled "Regional Setting," "Flora and Fauna," "Climate," and "Hydrology" were adapted from URS (2008: Section 2.1) and emphasize the non-archaeological aspects of these themes.

The proposed project is located in an undeveloped area of the Mojave Desert approximately 115 miles east of Los Angeles and 37 miles east of Barstow, California along Interstate Highway 40 (I-40). The Cady Mountains border the Calico Solar Project area of potential effect's (APE's) northern and eastern boundaries. Cady Peak is approximately 4 miles northeast and Sleeping Beauty Mountain is 5 miles to the east. Nearby urban communities include Newberry Springs and Ludlow, both approximately 12 miles to the west and east, respectively, of the Calico Solar Project APE. The Calico Solar Project APE is located within the Mojave Valley-Granite Mountains ecological subsection (Subsection 322Ah) of the broader Mojave Desert (Miles and Goudey 1997). The general environmental setting is that of a wide valley within arid desert, along which is an expansive alluvial fan that is dissected by numerous unnamed south-southwest trending washes and ephemeral drainages.

No springs are indicated on the USGS quad maps for the Calico Solar Project APE, although three well sites do occur on the USGS quad maps and were observed during the pedestrian survey. Of these, the well located in southwestern quarter of Section 1 of Township 8 North, Range 5 West (Hector – 1982 Provisional 7.5 minute series quad) has water present. The nearest reliable water source existing outside the Calico Solar Project APE occurs approximately 12 miles to the west, in the Mojave Valley; numerous springs and wells surround the dry lake bed of ancient Troy Lake, which is just west of the Calico Solar Project APE. Water is seasonally available in the form of rain swollen drainages, as indicated by the existence of numerous washes originating in the Cady Mountains and off-site to the east. A substantial east to west drainage crosses the southern portion of the Calico Solar Project APE, eventually emptying into Troy Lake (AFC Figure 2.1-1). The presence of water in drainages and lakes was certainly greater during the terminal Pleistocene and early Holocene periods. Numerous dry stream drainages and lake remnants (*i.e.,* Troy Lake, Lavic Lake, and Broadwell Lake) are located in the vicinity of the Calico Solar Project APE and attest to this increased presence of water. Based on paleoenvironmental data, the general climatic pattern in the Mojave Desert seems to be that of cool and wet periods, followed by warmer and drier conditions, from the Late Pleistocene through the Late Holocene periods, as reflected in the numerous dry lake beds that are interspersed throughout the area (Sutton, *et al.,* 2007; S. Hall 1985; Spaulding 1991).

Geology

The Mojave Desert Geomorphic Province is a wedge shaped area largely bound by major faults and structurally referred to as the Mojave Block. The Mojave Desert Geomorphic Province is characterized by broad expanses of desert with localized mountains and dry lakebeds and is bound by the San Bernardino Mountains and the Pinto fault to the south, the San Andreas fault to the west, the Garlock fault to the north and the Basin and Range Province to the east. The block itself is cut by a series of northwest to southeast striking faults including the Helendale, Lenwood, Johnson Valley, Camp Rock, Emerson, Calico, Pisgah, Bullion and Lavic Lake faults. Collectively, the strike slip faults in the Mojave Block are referred to as the Eastern California Shear Zone (ECSZ).The Project APE is within a broad valley between the Southwestern and Southeastern Cady mountains, in the central portion of the Mojave Desert Geomorphic Province.

The Calico Solar Project area is characterized by Holocene-age and Pleistocene-age alluvial deposition. Alluvial deposits from the adjacent highlands are composed of silty sands and gravels with localized gravel and cobble channels. These sandy alluvial deposits may be locally intertwined with finer-grained basin deposits. The bounding highlands, which include a small portion along the northern Calico Solar Project boundary, are underlain by granitic and metamorphic terrain and along the southern edge by younger volcanic deposits (Dibble and Bassett 1966).

Geomorphology

The deposition history is dominated by older (Pleistocene) and younger (Holocene) fanglomerates consisting of sands and gravels flowing in a generally southern direction, derived from the uplifted granitic and andesitic Cady Mountains (Dibblee and Bassett 1966). The older alluvium dominates the upper reaches of the fanglomerate, whereas the younger deposits dominate the lower reaches of the slope. This younger alluvium includes materials associated with a substantial east to west drainage that crosses the southern portion of the project. Although limited data is available, field observations indicate a substantial depth to the fanglomerate deposits. Older fanglomerates and alluvium form low hills in the southern-most extent of the project APE and are separated from the remainder of the Calico Solar Project APE by the drainage noted above. These hills, and a northward extension of the Pisgah lava flow, channel the drainage towards Troy Lake to the west.

A major factor affecting the geomorphology of the Mojave, and specifically the Calico Solar Project APE and its environs, is the Mojave River itself. This river and its drainage system represent the largest present-day hydrological system in the Mojave Desert (Enzel 2003:62). Fluctuations in the paleoclimate between wet and dry periods, coupled with the changing path of the sizable Mojave River, resulted in the formation of several freshwater lakes, the most notable of which are Lake Manix and Lake Mojave. As the river changed its course, the overabundance of freshwater would be transported and deposited into naturally occurring basins along or at the terminus of the Mojave River. Marith Reheis and co-authors (2007) note that Lake Manix consists of several subbasins, which are referred to as Coyote Lake, Troy Lake, Manix, and Afton. As the lake developed, "fluvial and deltaic sediments were deposited progressively eastward into the lake" and that studies have hypothesized that there were at least four major lake cycles (2007:5). Based on geological and geomorphological studies the Lake Manix shoreline reached an elevation of 557 meters (m). At this level, the southern extent of the lake itself would have pushed east, potentially abutting the westernmost Calico Solar project APE (Enzel 2003; Reheis *et al.,* 2007: Figure 3).

The occurrence of desert pavements within the Calico Solar Project APE reflects the context as described above. In particular, the pavements on the slopes of the Cady Mountains are broader and better developed atop the older, up-slope Pleistocene fanglomerates rather than on the younger surfaces at lower elevations. The older surfaces, and likely the younger ones as well, predate the accepted presence of man in the new world. The most stable pavements, and likely the oldest, lie atop Quaternary alluvium woven among the fanglomerate hills and lava flows within the southern portion of the project APE. Buried cultural deposits would not be found beneath these stable surfaces. The cryptocrystalline silicate nodules that occur as part of the desert pavement matrix may be secondarily sourced to the fanglomerate deposits, though their original matrix remains unknown. Holocene alluvial deposits within and adjacent to the east-west drainage are the most likely source for buried deposits. The loose sandy matrix and the seasonal rain and flood events are likely to have obscured portions of cultural deposits.

Biology

California's diverse environment is separated into 10 different bioregions. The Calico Solar Project APE lies within the Mojave Bioregion. The Mojave Bioregion is an arid desert environment which covers over 25 million acres of Southern California, Southern Nevada and the Southwestern Utah and is characterized by desert washes, high plateaus, mountain peaks, palm oases, and large dry prehistoric lake beds called playas. These playas usually consist of sand and gravel basins surrounding central salt flats and were formed by pluvial lakes which once dominated the Mojave Bioregion. The Mojave is bordered on the north by the Sierra Nevada Bioregion, on the west by the Transverse and Peninsular ranges and is separated from the Great Basin, on the east, by the Garlock Fault (Moratto 1984:16, 17). Elevations in the bioregion average between 2,000 to 3,000 feet above sea level and contain isolated peaks of 6,000 to 7,000 feet above sea level.

Although the desert appears barren and remote, it contains a large variety of plant and animal life. Vegetation in the Mojave Bioregion includes Mojave creosote bush, scattered desert saltbush, Joshua tree scrub, alkali scrub, juniper pinyon woodland, numerous varieties of cacti, and hardwood and conifer forests in the higher elevations. Rare plants in the bioregion include white bear poppy, Barstow woolly sunflower, alkali mariposa lily, Red Rock poppy, Mojave monkey flower, and Stephen's beartongue. (Ceres, n.d.). The Mojave Bioregion is characterized by hot dry summers followed by cool winters with occasional rainstorms that often develop into flash floods. Much of the land within the Mojave Bioregion is owned and managed by the BLM or contained in one of the three National Parks: Death Valley, Eastern Mojave, and Joshua Tree and several other recreational areas (Ceres, n.d.).

Current Physical Setting

The Calico Solar Project APE is located north of I-40 at Hector Road with the BNSF Railway tracks bisect the northern and southern portions of the project APE. Historic U.S. Route 66 roughly follows a similar route as I-40 though both are discrete features within the Project APE. A series of underground pipelines are also present within the Calico Solar Project (Phase 2) APE, situated south of the BNSF railroad tracks and north of I-40. Four series of transmission towers also occur along the eastern-southeastern project APE. These towers include a pair of historic steel towers, a wooden transmission tower line, and a modern transmission tower. The Pisgah Substation is included in the Calico Solar Project APE, and is located within a triangular shaped parcel to the north of an I-40 temporary access route. Two radio facilities are located within the vicinity of the Calico Solar Project APE; one is situated to the southwest and the other to the east-northeast of the Calico Solar Project APE.

The Calico Solar Project APE is distinctively rural in nature and the landscape's environs are characterized by cattle ranching activities (*e.g.,* grazing, rangeland), historic mining, and historic and modern railroad activities. Historic mines occur throughout the region, and include the Black Butte Mine to the east and the Logan Mine to the north. Both the Logan and Black Butte Mines were used for the extraction of the mineral manganese and both are located within 1 mile of the Calico Solar Project APE. The historic mines consist of borrow pits and open pit mines. The Pisgah Crater, a volcanic cinder cone, is approximately 4.5 miles south-southeast of the Pisgah substation, beyond the southeast corner of the project APE. The Pisgah Crater is on private land and has been mined for landscape rock, which has reduced much of the cinder cone from its original state.

The majority of the Calico Solar Project APE is relatively undisturbed and the landscape/topography generally resembles its natural environment. There are no standing, intact structures within the Calico Solar Project APE, only dilapidated mining related structures, mining processing equipment, corrals, water tanks, barbed wire fencing, and historic transmission poles, transmission line corridors and power facilities (*e.g.,* the Pisgah substation). Those of historic-age were recorded and/or updated and evaluation recommendations are provided in Sections 6 and 8. The primary sources of the previous surface and subsurface disturbance in and adjacent to the project APE are, in no specific order, related to cattle grazing, off-road vehicle use, mining, pipeline construction, railroad construction and use, dirt access road grading, maintenance, and use, National Old Trails Road construction and use, U.S. Route 66 construction and use, I-40 construction and use, and the construction and use of the transmission lines and the Pisgah Substation. The project area lands are currently administered by the Bureau of Land Management (BLM) on behalf of the public and are used for off-road vehicle and other outdoor activities. (end of cited and slightly edited material taken from URS technical documents).

Project Construction

Project Construction Schedule

The Calico Solar Project would be developed in two phases. The schedule would be approximately 58 months in duration. Construction would require approximately 40 months.

Site Mobilization

Project facilities and amenities would be established during the first month of the build-out. The majority of these facilities would be located in the construction laydown area adjacent to the Main Services Complex. Project amenities would consist of site offices, restroom facilities, meal rooms, limited parking areas, vehicle marshalling areas/traffic staging, and construction material/equipment storage areas. Construction power to the project site facilities would be provided by mobile diesel-driven generator sets and/or temporary service(s) from SCE.

Project Site Preparation

Site preparation would be based on avoiding major washes and minimizing surface-disturbing activities. Also, areas of sensitive habitat and cultural resources would be avoided wherever possible.

Brush trimming would be conducted between alternating rows of SunCatchers^{TM}. Brush trimming consists of cutting the top of the existing brush while leaving the existing native plant root system in place to minimize soil erosion. After brush has been trimmed, blading for roadways and foundations will be conducted between alternating rows of SunCatchers^{TM} to provide access to individual SunCatchers^{TM}. Blading would consist of removing terrain undulations and would be limited to 3 feet in cut and 3 feet in fill. The blading operations would keep native soils within 100 feet of the pre-development location, with no hauling of soils across the site. Paved roadways would be constructed as close to the existing topography as possible, with limited cut-and-fill operations to maintain roadway design slope to within a maximum of 10%. Minor grading would also be required for building foundations and pads and parking areas in the Main Services Complex and substation areas.

The clearing, blading, and grading operations would be undertaken using standard contractor heavy equipment. This equipment would consist of, but not be limited to, motorgraders, bulldozers, elevating scrapers, hydraulic excavators, tired loaders, compacting rollers, and dump trucks.

Foundations

From the preliminary geotechnical investigations, it is expected that lightly loaded equipment and structures, including some of the equipment foundations in the substation yard, small equipment such as the fire water pump and standby generator, the support structures for the water treatment plant and the hydrogen storage area, and the transmission line lattice steel towers would be supported on shallow footings. Shallow footings would be continuous strip and isolated spread footings.

The majority of each SunCatcher^{TM} would be supported by a single metal pipe foundation that is hydraulically driven into the ground. These foundations are expected to be approximately 20 feet long and 24 inches in diameter. Shallow drilled pier concrete foundations of approximately 36 inches in diameter and an embedment depth with a minimum socketed depth into rock of 6 feet would be used for hard and rock-like ground conditions.

The buildings and major structures such as yard tanks would be supported on shallow spread and continuous footings or mat-type foundations.

Deep foundations would be required for heavy items, such as the power transformers at the electrical substation.

Operation Impacts

It is expected that the Calico Solar Project would be operated with a staff of approximately 164 full-time employees. The project would operate 7 days per week, generating electricity during normal daylight hours when the solar energy is available. Maintenance activities would occur 7 days a week, 24 hours a day to ensure SunCatcher^{TM} availability when solar energy is available.

Project Operations

Operation of the Project would generate wastes resulting from processes, routine maintenance, and office activities typical of solar electric generation operations. Non-hazardous wastes generated during operation of the project would be recycled to the greatest extent practical and the remainder of the wastes would be removed on a regular basis by a certified waste-handling contractor.

Inert solid wastes generated at the project site during operation would be predominantly office wastes and routine maintenance wastes, such as scrap metal, wood and plastic from surplus and deactivated equipment and parts. Scrap materials such as paper, packing materials, glass, metals, and plastics would be segregated and managed for recycling. Non-recyclable inert wastes would be stored in covered trash bins in accordance with local ordinances and picked up by an authorized local trash hauler on a regular basis for transport to and disposal in a suitable landfill.

Project operations would consist of few inputs, most of which would be associated with the day-to-day operations and maintenance of the facilities, and the resulting energy production would decrease the area’s reliance on imported non-renewable electricity. The existing transmission lines which run through the project site are convenient to this project, and adhere to the goals and policies of the Geothermal/Alternative Energy and Transmission Element. There are no recently proposed zone changes that affect this Calico Solar Project site, and no changes to the general provisions for development of solar energy are in the planning area.

Project Closure and Decommissioning

Project Closure

Project closure can be temporary or permanent. Temporary closure is defined as a shutdown for a period exceeding the time required for normal maintenance, including closure for overhaul or replacement of the major components, such as major transformers, switchgear, etc. Causes for temporary closure include inclement weather and/or natural hazards (e.g., winds in excess of 35 mph, or cloudy conditions limiting solar insolation values to below the minimum solar insolation required for positive power generation, etc.), or damage to the Calico Solar Project from earthquake, fire, storm, or other natural acts. Permanent closure is defined as a cessation in operations with no intent to restart operations owing to project age, damage to the project that is beyond repair, adverse economic conditions, or other significant reasons.

Temporary Closure

In the unforeseen event that the project is temporarily closed, a contingency plan for the temporary cessation of operations would be implemented. The contingency plan would be followed to ensure conformance with applicable LORS and to protect public health, safety, and the environment. The plan, depending on the expected duration of the shutdown, may include the draining of chemicals from storage tanks and other equipment and the safe shutdown of equipment. Wastes would be disposed of according to applicable LORS.

Permanent Closure

The planned life of the Calico Solar Project is 40 years; however, if the project is still economically viable, it could be operated longer. It is also possible that the project could become economically noncompetitive before 40 years have passed, forcing early decommissioning. Whenever the project is permanently closed, the closure procedure would follow a plan that would be developed as described below.

The removal of the project from service, or decommissioning, may range from “mothballing” to the removal of equipment and appurtenant facilities, depending on conditions at the time. Because the conditions that would affect the decommissioning decision are largely unknown at this time, these conditions would be presented to the Energy Commission, the BLM, and other applicable agencies.

To ensure that public health, safety, and the environment are protected during decommissioning, a decommissioning plan would be submitted to the Energy Commission for approval before decommissioning. The plan would discuss the following:

- Proposed decommissioning activities for the project and appurtenant facilities constructed as part of the project,
- Conformance of the proposed decommissioning activities with applicable LORS and local/regional plans,
- Activities necessary to restore the project site if the plan requires removal of equipment and appurtenant facilities,
- Decommissioning alternatives other than complete restoration to the original condition, and
- Associated costs of the proposed decommissioning and the source of funds to pay for the decommissioning.

In general, the decommissioning plan for the project would attempt to maximize the recycling of project components. Calico Solar would attempt to sell unused chemicals back to the suppliers or other purchasers or users. Equipment containing chemicals would be drained and shut down to ensure public health and safety and to protect the environment. Nonhazardous wastes would be collected and disposed of in appropriate landfills or waste collection facilities. Hazardous wastes would be disposed of according to applicable LORS. The site would be secured 24 hours per day during the decommissioning activities, and Calico Solar would provide periodic update reports to the Energy Commission, the BLM, and other appropriate parties.

Premature closure or unexpected cessation of project operations would be outlined in the Project Closure Plan. The plan would outline steps to secure hazardous and non-hazardous materials and wastes. Such steps would be consistent with Best Management Practices, the HMBP, the RMP, and according to applicable LORS. The plan would include monitoring of vessels and receptacles of hazardous material and wastes, safe cessation of processes using hazardous materials or hazardous wastes, and inspection of secondary containment structures.

Planned permanent closure effects would be incorporated into the Project Closure Plan and evaluated at the end of the project's economic operation. The Project Closure Plan would document non-hazardous and hazardous waste management practices including the inventory, management, and disposal of hazardous materials and wastes and the permanent closure of permitted hazardous materials and waste storage units.

Environmental Setting

Geology

With minimal updates and editorial contributions, the following subsection was adapted from URS (2008: Section 2.1) and emphasize the archaeological aspects of the Geology of the project area.

The Mojave Desert Geomorphic Province is a wedge shaped area largely bound by major faults and structurally referred to as the Mojave Block. The Mojave Desert Geomorphic Province is characterized by broad expanses of desert with localized mountains and dry lakebeds and is bound by the San Bernardino Mountains and the Pinto fault to the south, the San Andreas fault to the west, the Garlock fault to the north and the Basin and Range Province to the east. The block itself is cut by a series of northwest to southeast striking faults including the Helendale, Lenwood, Johnson Valley, Camp Rock, Emerson, Calico, Pisgah, Bullion and Lavic Lake faults. Collectively, the strike slip faults in the Mojave Block are referred to as the Eastern California Shear Zone (ECSZ).The Project APE is within a broad valley between the Southwestern and Southeastern Cady mountains, in the central portion of the Mojave Desert Geomorphic Province.

The project area is characterized by Holocene-age and Pleistocene-age alluvial deposition. Alluvial deposits from the adjacent highlands are composed of silty sands and gravels with localized gravel and cobble channels. These sandy alluvial deposits may be locally intertwined with finer-grained basin deposits. The bounding highlands, which include a small portion along the northern project boundary, are underlain by granitic and metamorphic terrain and along the southern edge by younger volcanic deposits (Dibble and Bassett 1966). This area was home to numerous small bands, tribes, and “tribelets” during the prehistoric and protohistoric periods.

Geomorphology

Present Process Geomorphology. Note: With minimal updates and editorial contributions, the following subsection was adapted from URS (2008: Section 2.1).

The deposition history is dominated by older (Pleistocene) and younger (Holocene) fanglomerates consisting of sands and gravels flowing in a generally southern direction, derived from the uplifted granitic and andesitic Cady Mountains (Dibblee and Bassett 1966). The older alluvium dominates the upper reaches of the fanglomerate, whereas the younger deposits dominate the lower reaches of the slope. This younger alluvium includes materials associated with a substantial east to west drainage that crosses the southern portion of the project. Although limited data is available, field observations indicate a substantial depth to the fanglomerate deposits. Older fanglomerates and alluvium form low hills in the southern-most extent of the Calico Solar Project APE and are separated from the remainder of the Calico Solar Project APE by the drainage noted above. These hills, and a northward extension of the Pisgah lava flow, channel the drainage towards Troy Lake to the west.

A major factor affecting the geomorphology of the Mojave, and specifically the Calico Solar Project APE and its environs, is the Mojave River itself. This river and its drainage system represent the largest present-day hydrological system in the Mojave Desert (Enzel 2003:62). Fluctuations in the paleoclimate between wet and dry periods, coupled with the changing path of the sizable Mojave River, resulted in the formation of several freshwater lakes, the most notable of which are Lake Manix and Lake Mojave. As the river changed its course, the overabundance of freshwater would be transported and deposited into naturally occurring basins along or at the terminus of the Mojave River. Marith Reheis and co-authors (2007) note that Lake Manix consists of several subbasins, which are referred to as Coyote Lake, Troy Lake, Manix, and Afton. As the lake developed, “fluvial and deltaic sediments were deposited progressively eastward into the lake” and that studies have hypothesized that there were at least four major lake cycles (2007:5). Based on geological and geomorphological studies the Lake Manix shoreline reached an elevation of 557 meters (m). At this level, the southern extent of the lake itself would have pushed east, potentially abutting the westernmost Calico Solar Project APE (Enzel 2003; Reheis *et al.,* 2007: Figure 3). Extensive prehistoric remains are found along the shores of the lake and it is thought to have been a major element in a regional network involving the inhabitants of the project and the project area of analysis.

The occurrence of desert pavements within the Calico Solar Project APE reflects the context as described above. In particular, the pavements on the slopes of the Cady Mountains are broader and better developed atop the older, up-slope Pleistocene fanglomerates rather than on the younger surfaces at lower elevations. The older surfaces, and likely the younger ones as well, predate the accepted presence of man in the new world. The most stable pavements, and likely the oldest, lie atop Quaternary alluvium woven among the fanglomerate hills and lava flows within the southern portion of the project APE. Buried cultural deposits would not be found beneath these stable surfaces. The cryptocrystalline silicate nodules that occur as part of the desert pavement matrix may be secondarily sourced to the fanglomerate deposits, though their original matrix remains unknown. Holocene alluvial deposits within and adjacent to the east-west drainage are the most likely source for buried deposits. The loose sandy matrix and the seasonal rain and flood events are likely to have obscured portions of cultural deposits.

Paleoecology

With minimal updates and editorial contributions, the following sections were adapted from URS (2008: Section 2.1).

The project area of analysis is composed of multiple Life Zones whose animal and plant communities attracted and tempered the settlement and adaptations of a long sequence of prehistoric and historic populations. The Life Zones are (from the highest altitude to the lowest): Arctic/Alpine (10,000 feet and above), Canadian/Hudsonian (7,000 to 10,000 feet), Transition (5,000 to 7,000 feet), Upper Sonoran (3,300 to 5,000 feet), and Lower Sonoran (3,300 feet and below). Although some prehistoric and historic inhabitants of the project visited one of more of these Life Zones at one time or another, most settlement and subsistence activities were concentrated in the Transition, Upper Sonoran, and Lower Sonoran Zones, that is, between 5,000 feet and -227 feet in altitude (approximately a mile vertical distance).

The inhabitants of the project area of analysis lived primarily in the Lower Sonoran Life Zone, where acorns and piñon nuts were gathered by groups in the foothills; honey mesquite, piñon nuts, yucca roots, mesquite and cacti fruits were gathered by groups in or near the desert (Bean and Smith 1978) when Troy Lake, Lavic Lake, and Broadwell Lake were wet During times when the lakes were dry, settlement and subsistence were focused on the Upper Sonoran Life Zone in the Cady Mountains and even father distant. Edible varieties of agave cactus grow naturally on the rocky slopes of the Cady Mountains. Acorns and pinyon nuts were traded from Cahuilla bands of the mountains and passes of the Upper Sonoran Life Zone and Transition Life Zone, and mesquite beans were often received in return. There is no archaeological evidence that dried fish from the lakes or the Colorado River were traded beyond the immediate area.

C.3.4.4 CULTURAL SETTING

Prehistoric Background

Regional Prehistoric Context. With minimal updates and editorial contributions, the following sections were adapted from URS (2008: Section 2.1).

The chronological sequence of the cultural complexes for the Mojave Desert initially proposed by Warren (1980, 1984) and Warren and Crabtree (1986), divides the prehistoric era into five temporal periods: Lake Mojave, Pinto, Gypsum, Saratoga Springs, and Shoshonean. The four earlier periods encompass what is called the Archaic Period of the Great Basin and, in the Saratoga Springs period, formative influences from the Southwest (Lyneis 1982), while the Shoshonean period includes the ethnographic era. Claims have been made for archaeological assemblages dating to periods earlier than Lake Mojave, but as Warren and Crabtree (1986) note, all are controversial and, even if valid, have little or no relationship to later cultural developments in the region.

The Mojave Desert sequence has recently been expanded by Sutton *et al.,* (2007) to include elements more closely aligned to prehistoric cultural complexes in the Central Mojave Desert. Similar to Warren and Crabtree (1986), Sutton *et al.,* (2007) notes little evidence of a “Pre-Clovis” occupation of the Mojave Desert during the Pleistocene, but does not discount the possibility of such evidence existing in the region. In contrast to the earlier sequence, Pleistocene era occupation is identified and termed the hypothetical “Pre-Clovis” and “Paleo-Indian” Complexes. Other elements of the Sutton *et al.,* (2007) Mojave Desert chronology for the Holocene period include the Lake Mojave complex, Pinto complex, Dead Man Lake complex, Gypsum complex, Rose

Spring complex, and Late Prehistoric complex, as described below. As used herein, “climactic periods (*e.g.,* Early Holocene) [refers] to specific spans of calendric time and cultural complexes (*e.g.,* Lake Mojave Complex) to denote specific archaeological manifestations that existed during (and across) those periods” (Sutton *et al.,* 2007:233).

Additionally, Sutton *et al.,* (2007: Table 15.1 and 15.2) provide good summaries of major archaeological research conducted in the Mojave Desert since 1982. Due to the advent of cultural resource management projects, primarily on military bases and on federal land in the Mojave, more than 3 million acres have been surveyed with more than 20,000 sites identified in the last 27 years. These include surveys at China Lake Naval Weapons Center, Edwards Air Force Base, Fort Irwin, Twenty-Nine Palms Marine Corps Center, and federal Bureau of Land Management Land (Basgall and Glambastiani 2000; Basgall 2004; Hall 1993; Warren 1991). In terms of excavation projects in the Mojave, work has been conducted on a wide range of site types, from Paleo-Indian sites to Late Prehistoric sites, several of which have provided radiocarbon dates that support the cultural chronology that has evolved with these more recent investigations (Sutton *et al.,* 2007: Table 15.3). The chronological sequence presented below is based on both the earlier and more recent archaeological survey and excavation projects in the Mojave.

Paleo-Indian Complex (10,000 to 8000 cal B.C.)

The Paleo-Indian Complex was an era of environmental transition between the late Pleistocene and early Holocene. The beginning of the Paleo-Indian Complex was characterized by increased rainfall and cooler temperatures, which formed deep lakes and marshes, even in the interior desert regions of California. As temperatures warmed at the start of the Holocene, glaciers slowly retreated, sea levels rose, and the interior lakes and marshes gradually evaporated over the millennia (Moratto 1984:78).

The earliest, clear evidence for human occupation of the Mojave Desert begins at about 12,000 years ago, while claims for earlier, pre-Holocene era occupations such as those made for the Calico Early Man site (Duvall and Venner 1979), Tule Springs (Harrington and Simpson 1961), Lake China (Davis 1978), and Lake Manix (Simpson 1958, 1960, 1961) remain unsubstantiated.

In 1926, a fluted point found in Folsom, New Mexico transformed the debate about the antiquity of the earliest inhabitants of the New World, pushing the date back to approximately 15,000 B.P. Since that time, many other sites containing this type of point have been identified throughout the United States. The Paleo-Indian Complex within the Mojave Desert is, thus far, represented exclusively by the Clovis Complex, though the relationship with the later Great Basin stemmed series points is also a consideration. The Paleo-Indian Complex experienced profound environmental changes, as cool, moist conditions of the terminal Wisconsin glacial age gave way to a warmer, drier climate of the Holocene (Spaulding 1990).

The China Lake site remains the only presumed occupation of the Paleo-Indian complex in the Mojave Desert for the late Pleistocene Period. China Lake is located near an ancient Pleistocene lake. Excavations at this site began in 1968 and lasted through the end of the 1970s (Moratto 1984:66-70). China Lake has a well-sealed stratigraphic context with prehistoric tools intermixed with the fossilized remains of extinct mammals. The tool sequence from the site suggests that China Lake was inhabited from as early as 9,200 cal. B.C. (Sutton *et al.,* 2007: 234). The earliest calibrated dates for China Lake are from habitation debris at the Pleistocene lakeshore that continued through 10,000 B.C., where Proto-Clovis and Clovis cultures were identified. Nearly all of the tools identified at this site were produced from obsidian and fine-grained cryptocrystalline silicates (cherts and jaspers).

One common theme among nearly all Paleo-Indian sites in North America is the tool assemblage: projectile points, hafted to the end of a spear and launched using a throwing tool (atlatl), made from fine-grained lithic material and fluted. Fluted points, defined as a component of the Clovis culture in California, have been found nearly throughout the entire state from coastal estuary environments to ancient Pleistocene lakeshores, which are now in desert areas. At least five sites near Cajon Pass have been identified containing fluted projectile points, suggesting an early occupation of approximately 12,000 BP, which corresponds to the “hypothetical Pre-Clovis” complex (pre-10,000 cal B.P) for San Bernardino County (Sutton *et al.,* 2007:236). In addition to fluted points, the Paleo-Indian tool assemblage was composed mainly of scrapers, burins, awls, and choppers, all used for the processing of animal remains and foodstuffs.

The late Pleistocene to early Holocene geological period of transition, approximately 14,000 to 8,000 BP, was a period of global climatic change and in the California interior, pluvial lakes formed from glacial melt (Roberts 1989). Some early researchers pose the theory of two different traditions relating to interior and coastal adaptation during this transition. Based on work in the Panamint Valley, Davis (1969) posited the theory of “Paleo-Desert,” a geographic distinction from Paleo-Indian sites of the “Paleo-Coastal” tradition. In the Paleo-Desert geographic region, Paleo-Indian sites are generally located along the shorelines of these ancient pluvial lakes (Davis 1969). No sites dating to this period have been recorded to date in the project area of analysis.

Lake Mojave Complex (ca. 8000 – 6500 cal B.C.)

The temporal period 8000 to 6500 cal B.C. is referred to as the Altithermal Climatic Phase in which there was a dramatic shift towards a much warmer environment in the desert regions, and which appears to have witnessed a near hiatus in the occupation of the Mojave Desert. During this time it seems that people living in the desert regions migrated towards the coastal region. The change in the climate affected the distribution of floral and faunal communities and correspondingly people migrated toward the coast to exploit littoral resources. A small frequency of ground stone implements is present during this time, from which infers limited hard seed grinding activities (Sutton *et al.,* 2007:237). The high incidence of extra-local materials and marine shell is interpreted as wider spheres of interaction than witnessed previously. Sutton *et al.,* (2007: 237) interprets these and other data as indicators of “a forager-like strategy organized around relatively small social units.”

Cultural materials dating from this Complex encompass the Playa cultures (Rogers 1939), the San Dieguito Complex (Warren 1967), and the Lake Mojave Complex (Warren and Crabtree 1986). This phase is considered ancestral to the Early Archaic cultures of the Pinto Complex, representing a shift toward a more diversified and generalized economy (Sutton 1996:228). The Lake Mojave assemblages, first identified at Lake Mojave (Campbell *et al.,* 1937), include Lake Mojave series projectile points (leaf-shaped, long stemmed points with narrow shoulders) and Silver Lake points (short bladed, stemmed point with distinct shoulders). Other diagnostic items include flaked stone crescents; abundant bifaces; and a variety of large, well-made scrapers, gravers, perforators, heavy core tools, and ground stone implements (Sutton *et al.,* 2007:234).

Millingstones generally occur in small numbers during this time. In the Mojave Desert and southern Great Basin, this assemblage is typically (but not exclusively) found around the margins of ancient lakes, although the role of the lakes in the overall adaptation remains unclear. According to Sutton (1996:229), Lake Mojave Complex sites occur more commonly in the eastern and central Mojave Desert, while rare occurrences have been noted within the western Mojave in the Lake China, Coso, and Owens Lake areas

The Lake Mojave cultural pattern seems to represent relatively small nomadic social units centered on foraging strategies with undefined hunting and lacustrine resource exploitation patterns. Studies conducted at Fort Irwin show a reliance on smaller taxa with less reliance on large game based on protein residue analysis; however, these data are contradictory to the cultural constituents recorded for this complex that suggest large game exploitation (Sutton *et al.,* 2007:237). There is an overlap in time between the Lake Mojave Complex and the Pinto Complex of approximately 1,000 years, in which continuity of technology occurs with a steady introduction of technologies referred to as the Pinto Complex. No sites dating to this period have been recorded to date in the project area of analysis.

<u>The Pinto Complex (ca. 6500 – 4000 cal B.C.)</u>

The Pinto Complex represents a broad continuity in the use of flaked stone technology, including less reliance on obsidian and cryptocrystalline silicates, as well as the prevalence of ground stone implements in the material culture (Sutton *et al.,* 2007:238), which distinguishes it from the Lake Mojave Complex. Climatic changes occur between the Early and Middle Holocene periods about 7500 B.P and 5000 B.P. appears to have been more arid across the Mojave region (S. Hall 1985; Spaulding 1991). It is during this time that woodland attained its approximate modern elevation range, and the modernization of desert scrub communities was completed with the migration of plant species such as creosote bush into the area (Byers and Broughton 2004). Warren (1984) sees this period as marking the beginning of cultural adaptation to the desert, as materials characteristic of the Pinto Complex gradually replace those of the preceding Lake Mojave Complex. Sites associated with this era are usually found in open settings, in relatively well-watered locales representing isolated oases of high productivity.

From the period 5000 B.C. to 3500 B.C., there was increased occupation of the desert regions during the Medithermal Climatic Period, a period of moister and cooler temperatures allowing for the intensive re-occupation of the desert region. In the desert region, the occupation is referred to as the Pinto Basin Complex. However, Sutton *et al.,* (2007:238) cite recent work conducted on Fort Irwin and Twenty-Nine Palms that produced radiocarbon dates as 6870 cal B.C., thus pushing the back the inception of the complex coincidental with the Lake Mojave Complex.

The Pinto Complex is marked by the appearance of Pinto series projectile points, characterized as thick, shouldered, expanding stem points with concave bases, as well as, bifacial and unifacial core tools, and an increase in millingstones. Pinto points were typically produced by percussion reduction, with limited pressure retouch. Named for the Pinto Basin site (Campbell and Campbell 1935), the points were presumably used on atlatl darts. Large numbers of such artifacts were also recovered from the Stahl site near Little Lake (Harrington 1957; Schroth 1994).

Major technological shifts for this Complex include a significant increase in the use of millingstones (Warren and Crabtree 1986; Sutton *et al.,* 2007:238)). Warren (1990) attributes the latter development to the exploitation of hard seeds, part of a process of subsistence diversification brought on by increased aridity and reduced ecosystem carrying capacity. Big game hunting probably continued as an important focus during this time, but the economic return of this activity likely decreased as mountain sheep and deer (artiodactyls) populations declined in response to increased aridity (Warren and Crabtree 1986). During this transitional period there is faunal evidence that indicates exploitation of rabbit, rodent, reptile, and freshwater mussel resources.

The majority of Pinto Complex archaeological sites have been found near pluvial lakes, adjacent to fossil stream channels, near springs, and in upland regions. Many of these sites contain substantial midden deposition and cultural debris, which indicates larger groups and prolonged occupation for this time period (Sutton *et al.,* 2007:238).

A new complex has been proposed by Sutton *et al.,* (2007) that appears to be a variation of the Pinto Complex: the Dead Man Lake Complex (7000-3000 cal. B.C.), based on archaeological findings from the Twenty-Nine Palms area. The primary variation between Pinto and the Dead Man Complex is the presence of small to medium sized contracting stemmed or lozenge shaped points, battered cobbles, bifaces, simple flaked tools, milling implements, and shell beads (Sutton *et al.,* 2007:239).

Based on the current archaeological data there appears to have been a gap between the Middle and Late Holocene period, since few sites have been found that date between 3000 and 2000 cal B.C. It is believed that climatic changes during this period resulted in hotter and drier conditions, which may have led to the abandonment this region for approximately 1,000 years (Sutton *et al.,* 2007:241).

No sites dating to this period have been recorded to date in the project area of analysis.

Gypsum Complex (ca. 2000 cal B.C. – cal A.D. 200)

Gradual amelioration of the climate began by around 5000 B.P, culminating in the Neoglaciation at about 3600 B.P., with a period of increased moisture dating to the latter part of the Middle Holocene (Spaulding 1995). This increase in moisture would have presumably resulted in favorable conditions in the desert, and may have influenced changes in cultural adaptations, including increasing population, trade, and social complexity (Sutton 1996: 232; Sutton *et al.,* 2007:241).

Gypsum Complex sites are characterized by medium to large stemmed and corner notched projectile points, including Elko series, Humboldt Concave Base, and Gypsum. In addition, rectangular-based knives, flake scrapers, occasional large scraper planes, choppers and hammerstones; handstones and milling tools become relatively commonplace and the mortar and pestle appear for the first time. One site with an Elko series projectile point was recorded in the project; no similar projectile points have been found in the project area of analysis.

This Complex is marked by population increases and broadening economic activities as technological adaptation to the desert environment evolved. Hunting continued to be an important subsistence focus, but the processing of plant foods took on greater importance as evidenced by an increase in the frequency and diversity of ground stone artifacts. Later, the bow and arrow were introduced, increasing hunting efficiency. Perhaps due to these new adaptive mechanisms, the increase in aridity during the late Gypsum Complex (after ca. 2500 B.P.) seems to have had relatively little consequence on the distribution and increase in human populations (Warren 1984; Warren and Crabtree 1986). In addition to open sites, the use of rock shelters appears to have increased at this time. Base camps with extensive midden development are a prominent site type in well-watered valleys and near concentrated subsistence resources (Warren and Crabtree 1986). Additionally, evidence of ritualistic behavior during this time exists through the presence of rock art, quartz crystals, and paint (Sutton *et al.,* 2007:241).

A shift in subsistence orientation and mobility near the end of the Gypsum Complex is suggested, with increased emphasis on the hunting of smaller mammals (Basgall *et al.,* 1986; Sutton 1996:234). Rock art suggests that the hunting of mountain sheep was important during the Gypsum Complex (Grant *et al.,* 1968); mountain sheep and deer, rabbits and hares, rodents, and reptiles remains are reported from Gypsum Complex sites in the central Mojave Desert (Hall and Basgall 1994). Evidence from the western Mojave Desert suggests that there was a major population increase ca. 3000 to 2300 B.P (Gilreath and Hildebrandt 1991; Sutton 1988).

Rose Spring Complex (ca. cal A.D. 200 – 1100)

The climate during the Rose Spring Complex remains relatively stable and consistent during the middle of the Late Holocene period. In the western Mojave Desert, some regions show an increase in lake stands, such as at Koehn Lake during this time (Sutton *et al.,* 2007:241). At the beginning of this period lakes were at high points; as the environment began to shift towards the end of this period, lakes began to desiccate and recede, which marked the end of the Rose Spring Complex around AD 1100.

The Rose Spring Complex is characterized by small projectile points, such as the Eastgate and Rose Spring series, stone knives, drills, pipes, bone awls, various milling implements, marine shell ornaments; the use of obsidian is prevalent during this time (Sutton *et. al.,* 2007:241). Smaller projectile points appear to mark the introduction of a bow and arrow technology and the decline of the atlatl and spear weaponry (Sutton 1996: 235). Sutton (1996: 235; 2007:241) notes that Rose Spring Complex sites are common in the Mojave Desert and are often found near springs, washes, and lakeshores.

Subsistence practices during the Rose Spring Complex appear to have shifted to the exploitation of medium and small game, including rabbits/hares and rodents, with a decreased emphasis on large game. At the Rose Spring archaeological site, numerous bedrock milling features, including mortar cups and slicks, are associated with rich midden deposits, indicating that milling of plant foods had become an important activity. In addition, evidence of permanent living structures are found during this time and include wickiups, pit houses, and other types of structures (Sutton *et al.,* 2007:241). In the eastern Mojave Desert, agricultural people appear to have been present, as Anasazi populations from Arizona controlled or influenced a large portion of the northeastern Mojave Desert by cal A.D. 700 (Sutton *et al.,* 2007:242).

No sites dating to this period have been recorded to date in the project area of analysis.

Late Prehistoric Complexes (cal A.D. 1100–Contact)

Paleoenvironmental studies conducted within the western Mojave Desert point to increased effective moisture beginning just after 2000 B.P., as evidenced by a shoreline bench feature at Koehn Lake (Sutton 1996:238). The Koehn Lake site appears to have been abandoned by 1,000 years ago, as Koehn Lake desiccated during a major "medieval drought." This drought may have influenced the movement of people from this area north and east across the Great Basin (Sutton 1996:239). Population began to decrease, due in part to a drier climate, and later as a result of European contact.

Characteristic artifacts of this Complex include Desert series projectile points (Desert Side-notched and Cottonwood Triangular), Brownware ceramics, Lower Colorado Buff Ware, unshaped handstones and millingstones, incised stones, mortars, pestles, and shell beads (Warren and Crabtree 1986). The faunal assemblages typically contain deer, rabbits/hares, reptile, and rodents. The use of obsidian dropped off during this time with the increased use of cryptocrystalline silicates.

Between 1,000 and 750 years ago, ethnic and linguistic patterns within the Mojave Desert increased in complexity. One of the most important regional developments during the Late Prehistoric Period was the apparent expansion of Numic-speakers (Shoshonean groups) throughout most of the Great Basin. Many researchers accept the idea that sometime around A.D. 1,000, the Numa spread eastward from a homeland in the southwestern Great Basin, possibly from Death Valley (Lamb 1958) or Owens Valley (Bettinger and Baumhoff 1982). While there is little dispute that the Numic spread occurred, there is much disagreement over its mechanics and timing (see Madsen and Rhode 1995).

The Late Prehistoric Complexes mark the first recorded historical documentation of Native American inhabitants at European contact. The ethnohistoric record provides valuable data for understanding Late Prehistoric archaeology. The Late Prehistoric Complexes reveal a significantly different suite of material culture than that seen in earlier Complex assemblages. Manos and millingstones became more frequent, as did mortar and pestles. In addition, bow and arrow technology with the use of Desert Side-notched and Cottonwood points, both emerge during the Late Prehistoric Complexes. Large occupation sites, representing semi-permanent and permanent villages, emerge during this time as well.

During this time the first locally produced pottery is seen in the Mojave Desert Region, likely coming from the Anasazi in the southwest. Also, smaller projectile points, Cottonwood and later Desert Side- Notched points were introduced to use with bow and arrow technology. Plant food processing is indicated by the presence of manos and metates.

Ethnography

Prehistorically, there was a large movement of people across the Mojave Desert and ethnographically several groups are associated with the Project APE and surrounding Mojave Desert region. The Kawaiisu, Kitanemuk, Southern Piute, Serrano, Chemhuevi, Tabtulabal, and Panamint occupied the Mojave Desert region, north, south, west, and east of the Project. In this region there were four major linguistic groups originating from northern Uto-Aztecan groups; Tubatulabalic, Hopic, Numic, and Takic (Sutton *et al.,* 2007:243). The Mojave River appears to have been a major boundary between Takic and Numic speaking groups during prehistoric times. Groups occupying the Central Mojave Desert were of the Takic and Numic linguistic groups. Takic speaking groups originated in the southwestern Mojave Desert, expanding south and east sometime around 500 cal. B.P, and include the Serrano and Kitanemuk (Sutton *et al.,* 2007:243). At time of contact, groups south of the Mojave River and much of southern California were part of the Takic linguistic group. The groups north and east of the Project were of the Numic linguistic group, which included the Kawaiisu, Chemhuevi, and Southern Piute.

During the ethnographic period, the Serrano, Vanyume (Beñeme) and the Chemehuevi occupied the region in which the Project is located. The Vanyume were a small division of the Serrano, about whom little ethnographic information is known. The Chemehuevi entered the Mojave Desert much later in time. Other groups that could have entered the Project area were the Kawaiisu, the Kitanemuk, the Southern Piute, the Mohave, and the Ancestral Pueblo. Eerkens (1999:301) states that the area around Fort Irwin, northeast of the Project Site, was inhabited by the Kawaiisu, Chemehuevi, Las Vegas Paiute, and the Vanyume, although he acknowledges that all groups in the area maintained flexible settlement patterns based on availability of resources (1999:302). The Project APE and surrounding valleys were not conducive for large scale inhabitation based on the fluctuating environmental conditions and overall arid nature of the region; therefore groups occupying/utilizing the area would have been small and nomadic (Zigmond 1986:398).

Serrano. The Project APE is situated within the traditional boundaries associated with Mission San Gabriel during the Spanish Period (1769–1821) (Bean and Vane 1979). The natives in this area were known as the Yucaipaiem clan of the Serrano (Altschul, Rose and Lerch 1984; Kroeber 1925; Strong 1929; Bean and Smith 1978). They spoke a language that falls within the Takic family of the Uto-Aztecan language group. This language family is extremely large and includes the Shoshonean groups of the Great Basin. Due to the proximity of the Serrano and Gabrieliño bands in the area and their linguistic similarities, ethnographers have suggested that these two bands shared the same ethnic origins (Kroeber 1925; Bean and Smith 1978). For this reason, they will be referred to as the Serrano.

According to Kroeber (1976:611), the Serrano comprised five groups or bands: Kitanemuk, Alliklik, Vanyume, Kawaiisu and Serrano. They inhabited lands from the San Bernardino Mountains, part of the Transverse Mountains east of the Cajon Pass, across the Mojave Desert east as far as Twenty-Nine Palms, and from the Tehachapi

Mountains to the northern Colorado Desert. They occupied most of modern day San Bernardino County (Bean and Smith 1978). Relatives of the Serrano included the Gabrieliño and Luiseño to the west at the Pacific Coast, and the Cahuilla inhabiting the Colorado Desert. For much of the Late Prehistoric Complex, the Serrano band of the much larger Serrano tribe were the likely inhabitants of the western Mojave Desert, what is today the Cajon Pass and Barstow area. Most of what is known about the Serrano has been based upon the work done by Hicks (1958) and by later researchers working on a site known as CA-SBR-1000, located near Yucaipa, San Bernardino County, California. Studies indicate that the village had been occupied for thousands of years and that it was a major trading center both prehistorically and historically. Little is known about early Serrano social organization because the band was not studied until the 1920s (Kroeber 1925) and enculturation had seriously compromised their native lifeway. Kroeber (1925) indicates that the Serrano were a hierarchically ordered society with a chief who oversaw social and political interactions both within their own culture and with other groups. The Serrano had multiple villages ranging from seasonal satellite villages to larger, more permanent villages.

Resource exploitation was focused on village-centered territories and ranged from gathering and hunting with occasional fishing. The primary staple varied depending on locality. Acorns and piñon nuts were gathered by groups in the foothills; honey mesquite, piñon nuts, yucca roots, mesquite, and cacti fruits were gathered by groups in or near the desert (Bean and Smith 1978). Hunting activities consisted of deer, mountain sheep, antelope, rabbits, other small rodents, birds, with the most desired game bird quail (Bean and Smith 1978).

Serrano structures were situated near water sources and consisted of large, circular thatched and domed structures of willow and covered with tule thatching. These living structures were often sufficient to house a large family. In addition to the living structure, a ramada, an open air structure for outdoor cooking, was located adjacent to the home (Benedict 1924; Kroeber 1925; Drucker 1937; Bean and Smith 1978). A large ceremonial structure was often present and was used as the religious center where the lineage leader resided. Additional structures, such as granaries for food storage and sweathouses for ritual activities, were often located adjacent to pools or streams (Strong 1929; Bean 1962-1972; Bean and Smith 1978).

The Serrano, like the neighboring groups, were primarily semi-nomadic, hunter-gatherers. Because of their inland location, Serrano society was left relatively intact during the period of initial Spanish colonialization, unlike the Gabrielino, who inhabited the coastal area. In 1772, Spanish explorer Pedro Fagès traveled through the Cajon Pass to the Mojave Desert in an attempt to identify the native groups in this region. Fages' ultimate goal was to place the Serrano under supervision of a mission. By 1819, the Serrano were relocated to the Estancia of the Mission San Gabriel in Redlands (Bean and Smith 1978:573). At the time of relocation, there were likely on the order of 3,500 Serrano inhabiting the Mojave Basin. Between 1840 and 1860 a smallpox epidemic decimated the population. By 1885, there were only "390 Serranos [sic] remaining in all of southern California" (AccessGenealogy.com 2005) and the census of 1910 recorded only 100 Serrano (Kroeber 1976:616).

Vanyume (Beñeme). Limited information is available on the Vanyume during the historic period. What information exists describes the Vanyume as a small division of the Serrano living in the Mojave Desert, north of Serrano territory. They were referred to as the "Serrano of the Mohave River" (Kroeber 1925:614). The name Vanyume is a Mohave word; the name Beñeme was given to the entire Serrano cultural group by Father Garcés. The Vanyume spoke a Takic language related to the Kitanemuk to the west and the Serrano to the South. Kroeber reported that the Vanyume were occasionally friendly with the Mohave and Chemehuevi, but hostile to the Serrano (Kroeber 1925:614). Kroeber also stated that the population of the Vanyume was very small at the time of historic contact. The "chief" of the Vanyume reportedly lived in one of the villages at the upper reaches of the Mojave River near Victorville. The Vanyume were hunters and gatherers, and shell beads and millingstones were known to have been used. The Vanyume are generally associated with similar life ways as the Serrano to the south (Yohe II and Sutton 1991).

Chemehuevi. The Chemehuevi were a band of the Southern Paiute that possibly entered the eastern Mojave Desert area from the north in fairly recent prehistoric times. The Chemehuevi, also called the Pah-Utes, were closely related to the Southern Paiute in Death Valley and the Southern Nevada region. At the time of ethnographic contact, the Chemehuevi claimed a large portion of the eastern and central Mojave Desert, perhaps as far west as Afton Canyon on the Mojave River (Kelly and Fowler 1986:368). Although the Chemehuevi territory boundaries are unclear, it is certain that they inhabited the Providence Mountains. Based on archaeological data, the Chemehuevi entered the Mojave Desert sometime in the 17th century (Yohe II and Sutton 1991).

The Chemehuevi were strongly influenced by the Mohave. It is possible that they displaced the Desert Mohave, a Yuman speaking group (Kelly and Fowler 1986:368). Many Chemehuevi words are related to Mohave vocabulary, along with agricultural practices, house construction, warfare, and other cultural elements such as religious practices. Like the Mohave, the Chemehuevi used square metates, paddle and anvil pottery techniques, and hair dye (Kelly and Fowler 1986:369). In addition to their close association with the Mohave, the Chemehuevi traded widely with the Shoshone, Kawaiisu, Serrano, Vanyume, Cahuilla, and Diegueno (Kelly and Fowler 1986:369).

Influence from the Pueblo area to the east is seen in the form of agricultural practices of many of the Southern Paiute groups. The Chemehuevi, in more well watered areas and flood plains, grew yellow maize, gourds, beans, and winter wheat, combining Mohave and Pueblo practices (Kelly and Fowler 1986:371). Kroeber reported that the Chemehuevi occasionally farmed small areas of corn, beans, melon and pumpkins and wheat. In more arid areas the Chemehuevi were hunter-gatherers. They hunted large game, such as deer and mountain sheep, along with rabbits, rodents, lizards, and other small game (Kroeber 1925:597). Plant foods were of great importance and included a variety of grass seeds, pinyon, and mescal (yucca).

The Chemehuevi had a large range associated with seasonal food practices and traveled through most of the Mojave Desert as far as the Tehachapi area and the San Bernardino Mountains. Occasionally they traveled to the Pacific coast to collect haliotis shells (Kelly and Fowler 1986:377). It was also reported that they would travel as far east as the Hopi's territory, about a two-month round trip (Kelly and Fowler 1986:377).

Little is known about the Chemehuevi material culture. However, in historic times they used basketry, primarily willow, to a great extent both for storage and for carrying possessions (Kroeber 1925:97). They also made basketry hats. The Chemehuevi used some pottery but relied more on basketry.

Spanish colonization had little effect on the Chemehuevi until the early 1800s. Although other Southern Paiute groups were enculturated earlier by the Spanish, the Chemehuevi's isolated territory protected from being assimilated into the mission system. With the opening of the Old Spanish Trail, the Chemehuevi became more affected by the Spanish, and were brought to the missions to work (Kelly and Fowler 1986:386).

In 1874, the United States government established the Colorado River Reservation in an effort to move the remaining Chemehuevi onto the reservation. However, the reservation was shared with the Mohave band, with whom the Chemehuevi had differences from 1865 to 1871, the Chemehuevi were at war with the Mohave. They were therefore, reluctant to move to the reservation (Kelly and Fowler 1986:388). Some of them were either forced to move to the reservation, while some of them would not move. Many stayed in their historic locations, finding work on farms and ranches and in mines. In 1901, the Chemehuevi received their own reservation in the Chemehuevi Valley.

Other Native American Groups Associated With the Region. In addition to those groups affiliated with the Project area, many other groups occupied and utilized the Mojave Desert in a variety of ways. For example, it appears that the Anasazi of southern Nevada greatly influenced the cultures within the region. By 1450 B.P., the Anasazi were exploiting turquoise deposits at Halloran Springs, approximately 25 miles northeast of the Calico Solar APE. The Anasazi Pueblo was 150 miles across the desert; therefore Anasazi miners must have spent a considerable amount of time in the area based on the amount of turquoise mined and the abundance of "Basketmaker III" pottery found near the springs (Fagan 2003: 310). Turquoise was mined up to 12 feet below the ground and for centuries Mojave turquoise was traded to the east of its source, throughout the Southwest; however, it does not appear that turquoise was traded to the west as evidence of it does not appear in the material cultural of California tribes.

About 1450 B.P., the use of bow and arrow technology spread throughout California's eastern deserts, eventually becoming the dominant hunting technology throughout California. The bow and arrow has many advantages over spears and atlatls and made hunting much more efficient. Bow and arrow technology could have been introduced to California by the Anasazi or by another Great Basin group, during this time. In addition, by 1200 B.P., buff, gray, and brownware pottery, made by Ancestral Pueblo groups and other surrounding tribes of the Lower Colorado River region, entered the Mojave Desert. The trade of technology along with items such as sea shells and steatite objects probably took place along the Mojave Trail (Fagan 2003:311) (Figure 2.8-1). Bow and arrow technology is appropriate, however, only if larger animals that can be hunted that way are available for the taking. Such game was usually unavailable in the valley of the project, but would have been more useful in the project area of analysis as there were larger game in the Cady Mountains and around the pluvial lakes or short term water holes in the old lake beds.

Other tribes in the region include the Mohave. The Mohave lived along both the east and west banks of the Colorado River. During the winter, they inhabited semi-subterranean houses and depended upon maize agriculture for subsistence (Kroeber 1902; 1925). Throughout the rest of the year they were a hunting and gathering group, often traveling west far into the Mojave Desert. The Mohave traveled throughout southern California and northern Arizona utilizing a large network of trails (King and Casebier 1976:281). Two major geographical features influenced the Mohave’s trade routes: the location of their villages along the Colorado River, and the waterless portions of the desert, also known as the Mojave Sink or Mojave Trough. Two major trade routes were used which started at villages along the Colorado River. The first route was the Pah-Ute Creek to Soda Springs route, which later became known as the Mojave Road wagon train. The other route ran south of the Mojave Road route through Poshay Pass and the Mojave River flood plain to the southeast corner of Soda Lake. The more northern route, the Mojave Road, was more heavily used, both prehistorically and in more recent historic times by Native Americans and European and American settlers alike (King and Casebier 1976:282).

Although the Mohave lived southeast of the project area, they potentially exercised a great amount of influence over the Mojave Desert region. They were skilled traders and traveled long distances to either fight or trade with other groups (Fagan 2003:297). Their movement across the southwest promoted the spread of new technologies, beliefs and ideas throughout the desert and southwestern regions. These Mojave transhumant patterns may have may have facilitated the knowledge, introduction, and sharing of arid lands water management techniques in the form of fields of rock piles to the project area of analysis and the broader desert region.

C.3.4.5 REGIONAL HISTORIC CONTEXT

With minimal updates and editorial contributions, the following sections were adapted from URS (2008: Section 2.1).

Spanish Period (1540 to 1821)

The Spanish had explored much of the California coast and San Francisco and Monterey bays by 1769, but paid little attention to the California interior. Several factors were detrimental to European exploration in the Project area: travel and communication were slow; there were few roads, trails and maps; and no supply stations existed in California’s interior deserts (King and Casebier 1976).

Between 1775 and 1776, Father Francisco Garcés, a Franciscan missionary originally stationed near present-day Tucson, Arizona, explored the Mojave Desert as part of Spain’s effort to forge an overland route to its settlements in Alta California. Garcés traveled with the 1775 Anza expedition until it crossed the Colorado River near present-day Yuma, Arizona (King and Casebier 1976:283). Garcés left the expedition at the Colorado River crossing and traveled north to the Mohave Villages near present-day Needles, California, while Anza continued west. Garces, in the company of Mohave guides, proceeded west to Mission San Gabriel in Los Angeles along the Mohave Trail, in the approximate location of the Mojave Road wagon route. The corridors of the Mojave Trail and the later Mojave Road are approximately 15 miles north of the Burlington Northern Santa Fe Railroad, north of the Cady Mountains near I-15. On his return trip he visited several Mohave villages on the banks of the Colorado River. The journal Garcés kept during this expedition is the earliest written record of the eastern Mojave Desert (King and Casebier 1976; Robinson 2005). Spanish contact with the Mohave and Colorado Desert peoples likely came from both the east and west during this time (Vane and Bean 1994:1-8), as evidenced by the Anza/Garces expeditions, as well as known contacts made on the California coast.

The closest Spanish mission, Mission San Gabriel in Los Angeles, was too far away to have an every day effect on the Native Americans in the Mojave Desert. Native Americans who fled the missions often escaped into the Mojave Desert and exposed the Mohave tribe to Spanish influences, including the use of horses, which led to raids on the missions and horse thievery. In 1819, Lieutenant Gabriel Moraga led an expedition of fifty soldiers into the Mojave Desert in an attempt to retrieve stolen horses, to exact revenge against the Mohave for their raids on the coastal Spanish settlements, and for their ability to spread unrest against the Spanish and other Native American groups (King and Casebier 1976:284). Moraga's expedition was only the second Spanish-sponsored trip into the Mojave Desert. Lack of water in the arid Mojave Desert forced Moraga and his soldiers to turn back.

During the Spanish period, no permanent European settlements were established in the project vicinity, although there were reports that the Spanish had active mines in the Barstow area. It is unknown if the mines were being worked by the Spanish, Native Americans, or later Mexican or American prospectors because only mine shafts remained and no written records have been discovered (King and Casebier 1976:300).

Mexican Period (1821 to 1848)

In 1810, an independence movement began as many rancheros sought to split Mexico (and California) from Spain. In 1821, this desire came to fruition when New Spain (Mexico) became independent. Following Mexico's independence, the Alta and Baja California missions received less financial support from Spain and Mexico, and ultimately, independence from Spain was a catalyst for Mexico to secularize all California missions. Secularization would free vast amounts of land that had been under mission control and the land would become civilian pueblos or large land grants awarded to Mexican, American, or European settlers. In 1831, Governor Jose Maria Echeandia announced the secularization of a number of missions, and by 1834, all the missions were secularized, including Mission San Gabriel in Los Angeles, the nearest mission to the Project. Within 10 years, the mission system had failed, the neophytes had left, and the buildings were in disrepair. Following secularization, San Gabriel mission became a parish for the City of San Gabriel and had little further effect on the Native Americans in the Project vicinity (Rolle 2003).

During Mexican control of Alta California, Americans started to enter California through the Mojave Desert, many of them using the Mojave Trail located north of the Project Area. Jedediah Smith, mountain man and fur trapper, was the first American to reach California using an overland route. Smith followed a route from the Great Salt Lake in Utah south to the Virgin and Colorado rivers and across the Mojave Desert to Spanish southern California. Smith arrived at the Mohave Villages in October 1826, then proceeded west on the Mojave Trail. After Smith's initial visit other American mountain men and trappers ventured into the desert, including William Wolfskill, George C. Yount, Christopher "Kit" Carson, James Ohio Pattie, and Ewing Young (Brooks and others 1981; King and Casebier 1976:285; Robinson 2005).

Jedediah Smith's ventures down the Virgin and Colorado rivers, combined with Garcés' route across the Mojave Desert, linked the Spanish settlements in New Mexico and California, stimulating trade between these regions (Wright 1982). In 1829, New Mexico merchant Antonio Armijo reached the Las Vegas Valley via the Virgin River, pioneering a route that became known as the Old Spanish Trail. Armijo's route followed the Mojave Trail in the project vicinity, but later routes of the Old Spanish Trail turned southwest out of Utah and headed toward the Mojave River through the San Bernardino Mountains. This route became known as the Northern Route of the Old Spanish Trail. The Mohave Indians had become increasingly hostile to travelers through their territories, and blazers of the northern route most likely took this path to avoid conflicts. The junction of the Northern Route of the Old Spanish Trail and the Mojave Trail was approximately 18 miles east of present-day Barstow, at a location historically called Fork of the Roads, northwest of the project area. Trade along the trail ended in 1848 with the Mexican-American War (Nystrom 2003; Robinson 2005; Rogge 2008).

No Mexican period artifacts have been found thus far in the project area of analysis.

American Period (1848 to Present)

Transportation

Mojave Road. The term "Manifest Destiny" was one of the likely causes for the Mexican-American War, which took place between 1846 and 1848. Jacksonian Democrats coined the phrase in the 1840s as a political philosophy whereby the United States would control all of the land between the Atlantic and Pacific oceans. The focus for expansion was on the northwest coast in Oregon territory and on the Texas territory. In 1845, during the Presidency of James K. Polk, the United States annexed Texas; the following year, the U.S. invaded Mexico. In 1848, the United States, victorious over the Mexican Army, signed the Treaty of Guadalupe Hidalgo, and acquired all Mexican territory north and west of the Rio Grande and Gila Rivers, which included Texas, New Mexico territory, and Alta California. American settlers began to migrate to the newly acquired territory, and the discovery of gold in 1848 and the ensuing Gold Rush in 1849 brought numerous settlers to California. Most of these travelers likely used the northern route of the Old Spanish Trail to enter California from New Mexico, Utah, and Nevada, although some likely followed the Mojave Trail as well (Robinson 2005).

Soon after California was granted statehood in 1850, the government wanted to recognize all of the trails running through California to promote immigration to the state, facilitate trade and communication, and develop routes of defense. A year after the Treaty of Guadalupe Hidalgo was signed, Lieutenant James H. Simpson of the Army Corps Topographical Engineers attempted to follow Father Graces' direct route across the Mojave Desert (Mohave Trail), and in 1851, the U.S. Army Corps of Engineers sent another expedition to explore the area. During the 1840s and 1850s, the Union Pacific Railroad also contemplated using Gracés' route in an attempt to find the most practical course for a railroad line across the desert. Several explorers, hired by railroad companies, traveled throughout the Mojave Desert during the 1840s and 1850s. Eventually, a more northern route was selected for the transcontinental railroad line. In the late 1850s the General Land Office in California began the process of mapping the Mojave Desert area, and at that time several groups of surveyors mapped the desert (King and Casebier 1976:288-289).

Beale's Wagon Road was built in 1857 north of the Calico Solar Project APE, along the 35th Parallel, and was in use between 1857 and 1861. Edward Fitzgerald Beale was a famous American Frontiersmen and was superintendent of the wagon road development. Beale, along with his party and 25 camels, crossed the Colorado River into California 15 miles north of present-day Needles, California, and followed the Mojave Trail west. In 1859, the U.S. Army established Fort Mojave near the location of Beale's river crossing in an effort to protect travelers from Mohave Indian attacks. As a result, the Mojave Trail developed into a wagon road, which allowed supplies to be brought to Fort Mojave overland from Los Angeles. The wagon road was called the Mojave Road or the Government Road and was actively used until the beginning of the Civil War in 1861.

During the Civil War, troops stationed at Fort Mojave were ordered to abandon the fort and report for duty in Los Angeles. The fort remained abandoned until the middle of 1863, when California Volunteers occupied it to protect travelers on the Mojave Road. Traffic had increased along the road as a result of gold discoveries about 100 miles south of Fort Mohave in the La Paz Mining District. Other travelers along the Mojave Road in the 1860s were members of the military on their way to Arizona to fight in the Apache Wars or merchants and ranchers hauling supplies and livestock to Prescott, the capital of the Arizona Territory. The Mojave Road also was used as a mail route between 1866 and 1868 (King and Casebier 1976; Nystrom 2003; Robinson 2005).

Although there was considerable traffic through the Mojave Desert into Southern California, most followed the Old Spanish Trail to the west of the Project APE or the Mojave Road to the north, and any settlements associated with these routes would have been located adjacent to the trails. Except for miners, most other settlers did not stay in the desert until a railroad was constructed. Only a few early homestead claims were filed. These early homesteads consisted mainly of ranches raising sheep and cattle. The arid environment prohibited large scale agriculture except on the banks of the Mojave or Colorado Rivers (Walthall and Keeling 1986).

Atlantic & Pacific Railroad. Plans for a transcontinental railroad had been delayed due to the Civil War, but once the war ended, interest in the construction of transcontinental railroads resumed. In 1866, Congress contracted the Atlanta & Pacific Railroad (A&P) to construct a railway from the east to the California border. In 1879, the A&P partnered with the St. Louis & San Francisco Railroad and the Atchison, Topeka, & Santa Fe Railroad to facilitate construction of the transcontinental railroad. The A&P began construction of their track in Albuquerque, New Mexico in 1880 and reached Needles, California in May 1883. The A&P constructed a bridge over the Colorado River at Needles in August 1883 (Gustafson and Serpico 1992; Myrick 1992; Robinson 2005).

As the A&P tracks were being laid, the Southern Pacific Railroad was constructing a new railroad line between Mojave and Needles to intercept the A&P tracks at the

Arizona border and protect its California interests. The Southern Pacific constructed the Mojave to Needles branch between 1882 and 1883, working east from their Mojave station (Gustafson and Serpico 1992; Myrick 1992). When surveyors initially explored the project vicinity for a viable railroad route, they assessed the Mojave Road corridor, and found that the terrain was too steep and unsuitable for railroad construction. In the arid Mojave, the trail through the mountain range was preferred to the flatter terrain because more sources of water could be found in the mountainous areas. In 1868, General William J. Palmer of the Union Pacific Railroad eastern division surveyed a railroad route to the south of the Cady Mountains, where the terrain was more favorable for railroad construction. Although the Union Pacific never constructed the railroad through the Mojave Desert, it was largely Palmer's route that the Southern Pacific used to construct the Mojave to Needles branch (Nystrom 2003; Robinson 2005).

For more than a year, the A&P and the Southern Pacific lines continued to operate independently. The Southern Pacific Railroad instituted tri-weekly service to Needles in 1883, but the trip through the Mojave Desert was long and desolate. The railroad had constructed only one station and turntable in the 124-mile stretch between Mojave and Ludlow. The Southern Pacific Railroad was reluctant to join rails with the A&P fearing that the completed line would compete with their newly constructed Sunset Route, which crossed into California further south on the Arizona border at Yuma. Passengers heading east on the Southern Pacific Railroad's line to Needles were inconveniently required to disembark from the train with their belongings and transfer to the A&P cars. Although each of the railroads developed local business, the volume of passenger travel was not large enough to support operations. The Southern Pacific Railroad's route through the Mojave Desert did facilitate mining operations in the area. Anticipating large future revenues from hauling bulk ore, the railroad provided water for miners at 2 cents per gallon anywhere on the route, putting an end to the water scarcity problem for mine development in the area (Myrick 1992).

By the end of 1883, the A&P began making plans to construct their own line parallel to the Southern Pacific's line across the Mojave Desert to San Francisco. The Southern Pacific Railroad realized that if the A&P constructed a parallel line across the desolate Mojave Desert, its line would essentially become useless. In October 1884, an agreement was signed in which the Southern Pacific Railroad would sell its Needles to Mojave section to the A&P for $30,000 per mile. Until the debt was paid, the A&P would lease the line. In addition, the A&P also received an option for trackage rights between Mojave and San Francisco. The A&P received full title to the Mojave to Needles branch in 1911 (Gustafson and Serpico 1992; Myrick 1992). The construction of the railroad changed the course of travel across the Mojave Desert in the project vicinity. The railroad provided travelers with water sources across the vast desert and travel was much easier along the flat railroad corridor than along the mountainous Mojave Road to the north. A wagon road was constructed adjacent to the railroad alignment and use of the Mojave Road decreased.

The California Southern Railroad joined with the A&P in 1885 to provide service from Kansas City to San Diego. The junction of the two lines was initially called Waterman Junction, but in 1886 it was renamed Barstow. Barstow is located approximately 40 miles west of the project APE and is the closest city. The construction of the railroad brought numerous settlers to the area and although other railroad lines were eventually constructed throughout southern California, the route passing through Barstow remained a popular line for both freight and passenger service. In addition, the railroad acted as a lifeline connecting Barstow, alone in the desert, to the rest of Southern California. Barstow was a sizable railroad hub, and the railroad was the main employer in the city for many years.

In 1897, the A&P was redesignated as the Santa Fe Pacific Railroad and later became the Atchison, Topeka, & Santa Fe Railroad. When the A&P took over the Mojave to Needles branch in 1884, there were depots at Daggett, Fenner, and Needles (Figure 2.8-1). During the 1880s, 1890s, and the first decade of the twentieth century, Santa Fe Pacific constructed facilities at various locations along the line. All of the structures were wood frame, with the exception of brick and reinforced concrete structures in Needles. Santa Fe Pacific railroad sidings in the project vicinity include Troy, Hector, Pisgah, and Lavic. The Hector siding is the closest to the Calico Solar Project APE. Neither the Pisgah or Troy sidings had any depot facilities. The building of the grade for the laying of the track through the Calico Solar Project APE may, however, have contributed to the burying of any cultural resources that were beneath, or immediately north of the track in its present location. Hector had a 12-by-14-foot wood frame telegraph and train-order office that was constructed in 1906, which was closed in 1923 and moved to Earp in 1934. The Lavic siding was the largest of the four with a 24-by-34-foot frame combination passenger and freight depot that was constructed in 1901. The depot was closed in 1923 and removed (Gustafson and Serpico 1992; Myrick 1992).

The lack of water along the Mojave to Needles branch required the railroad to haul water in large tanks to the stations and construction camps. In 1897, a station was constructed at Newberry Springs, approximately 6 miles west of Troy, and this station became the railroad's primary source of water in the region. Although freight trains typically carried surplus water cars, engineers often had to go back to Newberry Springs for additional water supply (Gustafson and Serpico 1992; Myrick 1992).

The A&P Railroad/Santa Fe Pacific Railroad/Atchison, Topeka & Santa Fe Railroad is located between the Calico Solar Project Phase 1 and Phase 2 APEs and within the Pisgah triangle area. The railroad is now operated as the Burlington Northern Santa Fe Railway.

National Old Trails Road and U.S. Route 66. Prior to the construction of the railroad between Needles and Barstow in 1883, travel across the Mojave Desert in the project vicinity was limited to the Mojave Road corridor, which evolved from a network of prehistoric trails, early trails developed by mountain men, early explorers, and gold seekers; and routes developed during the railroad surveys of the 1850s. After the railroad was completed, the travel corridor shifted south of the Cady Mountains, new roads were constructed between local mines and railroad sidings, and a wagon road was constructed adjacent to the railroad tracks from Barstow to the Arizona border (Hatheway 2001). In the first decade of the 1900s, this wagon road would be converted to an auto route, as the use and ownership of the automobile became more prevalent.

The automobile first made its appearance to the American public in the late 1890s, and by 1900 automobiles were still the toys of the wealthy, with only one for every one thousand Americans. Although Henry Ford introduced his Model T in 1907, widespread use of the automobile did not occur until after World War I. In 1914, Ford perfected full assembly line production and two years later more than half a million automobiles were sold. As the use of the automobile rose, the demand for good roads increased. Most rural roads in the 1900s had been constructed for wagon traffic and were not suited to automobile traffic (Fischer and Carroll 1988; Keane and Bruder 2004; Lyman 1999; Paxson 1946).

By 1910, national and local organizations promoted good roads in the United States, including the National Old Trails Road in the APE. A precursor to U.S. Route 66, in spirit but not always in location, the National Old Trails Road was part of the 2,448-mile ocean-to-ocean highway from Baltimore, Maryland to the California coast. The National Old Trails Road also was part of the National Auto Trail System, an informal network of automobile routes marked by local organizations in the early twentieth century. The National Old Trails Road, where it traverses the Project APE, was located along and in the vicinity of the alignment of the old wagon road that was constructed adjacent to the Santa Fe Railroad tracks in the 1880s. The highway was designated by booster organizations in 1912, and by 1914 the Auto Club of Southern California had provided signage for much of the highway (Keane and Bruder 2004; Robinson 2005; Wikipedia contributors 2008).

In 1916, the Federal Highway Aid Act was passed to help fund rural roads, using a 50/50 funding match for states with a highway department. Route planning, however, remained a local matter, which usually did not include engineering surveys. In 1919, Congress liberalized the funding match requirements, and by late 1921, Congress passed the Federal Highway Act that further reduced the state match to about 26% (Lyman 1999) and required federal aid to be concentrated upon “such projects as will expedite the completion of an adequate and connected system of highways, interstate in character” (Paxson 1946:245). Up to 7% of a state’s roads could be listed for reconstruction to create the national highway system. By 1923 a tentative plan had been developed linking every city with a population of 50,000 or more, with construction planned over a 10-year period (Paxson 1946).

During the early 1920s, automobile travel was an adventure for many Americans and was subsequently heavily promoted. By the late 1920s, much of the National Old Trails Road in the project vicinity had been widened and oiled or surfaced with gravelly sand. The segment of the highway across the Mojave Desert was notorious for its poor condition, and by 1925 the highway was full of ruts and chuck holes. The highway was narrow with no road shoulders or striping, tended to follow the natural topography of the area, and was vulnerable to the effects of erosion. The State of California had designated the highway as a public highway in 1919, but did not take any responsibility for the segment between Barstow and Needles until 1923, leaving the burden of maintenance to San Bernardino County. Despite the poor conditions, motorists were never more than 4 miles from the railroad, where they could find help in the form of stations and section crews, and water was available every 5 to 10 miles (Bischoff 2005; Hatheway 2001; Scott and Kelly 1988). Aggregate mining for sand and gravel became prevalent in the area (King and Casebier 1976) and the scraping scars for the aggregate for the pavement of the Hector section of the National Old Trails Road can still be observed in the APE.

In 1926, the American Association of State Highway and Transportation Officials designated the National Old Trails Road in the Mojave Desert as U.S. Route 66. U.S. Route 66 was one of the main arteries of the National Highway System and was one of the first great highways in the United States, running from Chicago to the Pacific Ocean. Federal funding allowed for improvements, such as the construction of road shoulders. In the 1930s, the original alignment of the National Old Trails Road in the Project Area was abandoned in favor of a route to the south, which is the current alignment of historical U.S. Route 66 (Bischoff 2005; Scott and Kelly 1988; Wikipedia contributors 2008).

The new U.S. Route 66 alignment eliminated sharp turns, reduced steep grades, and straightened the roadway to accommodate higher speeds. The use of heavy machinery allowed for large road cuts that had not been possible in the early days of road building. The section of U.S. Route 66 from Needles to Los Angeles was the most heavily traveled section of the highway, and in 1934 this segment was paved. Much of the paving of U.S. Route 66 was completed by the Works Progress Administration during the Great Depression of the 1930s. By 1938 all of U.S. Route 66 was paved (Bischoff 2005; Scott and Kelly 1988).

U.S. Route 66 was an important transportation route during the Great Depression. In his book, *The Grapes of Wrath*, John Steinbeck wrote about migration of Midwestern farmers to the Pacific coast along this roadway. World War II caused further migration to the west coast along U.S. Route 66 as millions of Americans went to work in war related jobs in California. U.S. Route 66 became so famous that it was memorialized in Bobby Troup's popular song "Get Your Kicks on U.S. Route 66" (Scott and Kelly 1988) and was featured in many Hollywood movies.

While accommodations in the Calico Solar Project APE were limited to road-site camping in the wilds, as a subsequent consequence of the heavy use of U.S. Route 66, thousands of businesses opened, mostly serving cross-country travelers. Businesses varied from grocery stores, service stations, restaurants, and motels to dance halls and tourist attractions. One of these tourist attractions in the project vicinity may have been the Pisgah Crater, a young volcanic cinder cone located south of the Project APE. A road was constructed from U.S. Route 66 to the Pisgah Crater between the late 1930s and early 1950s from U.S. Route 66 either to provide access for travelers along the highway or for local aggregate miners (Scott and Kelly 1988).

Barstow was the last stop from Los Angeles before crossing the desert or the first stop after the desert, and was a popular rest area along the highway even during the Depression. During that time, business from U.S. Route 66 was an important part of the economies of many towns and small cities. By World War II, many businesses along U.S. Route 66 competed for travelers' money. Native American crafts sales became an important industry along the route. During the war, military use of the road increased in conjunction with development of military training bases in the Mojave Desert (Scott and Kelly 1988).

The Golden Age of U.S. Route 66 was the era after World War II and before the opening of other major east-west interstate highways, such as Interstate 40 (I-40). The increased traffic along U.S. Route 66 also led to its demise. Although the highway was an important east-west thoroughfare, it could no longer handle the volume of traffic and heavy military equipment using the road. After World War II, a new national interstate highway system was planned, and eventually replaced much of U.S. Route 66 (Scott and Kelly 1988).

There are no historic buildings associated with U.S. Route 66 along the segment of the road that is within 0.5 miles of the Project APE. There are historical buildings associated with U.S. Route 66 in the town of Ludlow, located about 12 miles east of Pisgah and about 11 miles east of the Project, and in Newberry Springs, about 15 miles west of the Interstate 40 Hector exit and about 13 miles west of the Project.

Interstate Highways. Throughout the 1950s and 1960s, U.S. Route 66 remained the main road between the Midwest and the West Coast. Increased traffic and the narrowness of the roadway eventually led to the downfall of the road. On August 2, 1956, President Dwight D. Eisenhower signed the Federal Aid Highway Act which provided funding to upgrade America's roads. Eisenhower based his vision of a more connected America on Germany's Reichsautobahnen rural super highways. Eisenhower and his advisors originally envisioned creating a 40,000 mile interstate system costing approximately $27 billion. Construction began almost immediately throughout the United States (Weingroff 2008).

On December 13, 1958, Interstate 15 opened between Victorville and Barstow. This marked the beginning of the modern highway era in the Barstow area. The entire length of Interstate 15 from Los Angeles to Las Vegas was opened by July 1961. At that time, the stretch between Baker and Las Vegas was used by more than 500 vehicles an hour in one direction (Swisher 1997).

Interstate 40 begins at its junction with Interstate 15 in Barstow, then runs through the Mojave Desert to Needles and into Arizona. Interstate 40 is located along the southern edge of the Calico Solar Project APE. Although the Interstate 40 is now a cross-country highway, its last sections were not built until 1980. In the southwest, much of present day Interstate 40 absorbed U.S. Route 66. Many of the western portions of Interstate 40 also follow the Beale Wagon Road. The segment of Interstate 40 in the project vicinity was not constructed until 1968.

Mining in the Mojave Desert

Since the 1860s, mining has been the most important commercial industry near the Calico Solar Project APE. Silver was discovered in 1863, although it is possible the Spanish had mined in the area almost a century before. Prospectors attempted to establish mines to sell to investors with sufficient capital. In the following decade, smaller operators attempted to compete with larger corporations, but without railroad transportation, very little money was made until the early 1880s with the coming of railroad through the eastern Mojave Desert (Brooks and others 1980; King and Casebier 1976:300-305).

The period between 1900 and 1919 was known as the "the Great Years" for mining in northeastern San Bernardino County (King and Casebier 1976:305) as it was more profitable than any other time. Copper, lead, zinc, and other base metals, as well as gold and silver, were mined throughout the Mojave Desert and San Bernardino County.

Also, during World War I, chromium, manganese, tungsten, and vanadium were mined. Several large mining districts were developed, including Copper World, near Valley Wells; gold mines at Hart; lead, zinc, and copper in the Mohawk mines near Mountain Pass; copper mines near Von Trigger Spring; and gold mines at the north end of Old Dad Mountain (King and Casebier 1976).

During the Great Depression, a resurgence of gold mining took place, but World War II caused a return to the mining of base metals. The Vulcan Iron mine, in the Providence Mountains northeast of the Project, was excavated during that time. Since the end of World War II, mining in the area has considerably slowed. More recently, other nonmetals such as clay, talc, and cinder mining have gained popularity, especially around the Kingston Mountains in the vicinity of Interstate 15. Aggregate mining for sand and gravel has become prevalent in the area (King and Casebier 1976).

Manganese Mining in the Project Vicinity. Several manganese mines exist in this region, including the Logan Mine within the Calico Solar Project APE, and the Black Butte Mine, located just over one-half mile east of the Calico Solar Project APE. Manganese was first mined in earnest during World War I, when the demand increased due to its use in the production of iron and steel. After World War I, manganese mining throughout the country decreased and continued to wane throughout the Depression but once again increased with the onset of World War II in the 1940s. In addition to iron and steel production, manganese also was used in the minting of the war-time nickel between 1942 and 1945. By 1943, deposits of manganese had been located in several desert locations throughout San Bernardino County, including the Lavic, Owl, and Whipple Mountains. Manganese, in combination with copper and silver, was used to produce these coins in an effort to conserve nickel for military uses (Tucker and Sampson 1943).

In 1942, the Metal Reserve Company of Washington D.C. published competitive price schedules for manganese ores. They offered $48 per ton for high grade ore (ore containing 48% manganese), $35.20 per ton for low grade A ore (44% manganese), and $26.00 per ton for low grade B ore (40% manganese). Ores containing 35% to 39% manganese were also accepted at a reduced price. Manganese producers in San Bernardino County brought their ore to stockpile points in Parker and Phoenix, Arizona. Lower grade ores containing 15% to 35% manganese often took their ore to the Kaiser Steel Corporation in Fontana, California. In the early 1940s, manganese ore was shipped from 5 deposits in San Bernardino County with ore containing 20% to 46% manganese. After the war, several manganese deposits continued to be worked in San Bernardino County (Tucker and Sampson 1943; Wright and others 1953).

Southern California Edison and the Hoover Dam

Two parallel Southern California Edison (SCE) steel-tower 220-kilovolt transmission lines are located in the Pisgah Substation Triangle area and the historic built-environment 0.5-mile buffer of the Project APE. The SCE 220-Kilovolt North Transmission Line was constructed between 1936 and 1939 and the SCE South 220-Kilvolt South Transmission Line between 1939 and 1941. The transmission lines originate at the SCE switchyard at the Hoover Dam and terminate in Chino, California. The transmission lines were constructed to deliver power from the Hoover Dam to SCE service areas in southern California.

Plans for development of a hydroelectric plant on the Colorado River were conceived as early as 1902 in response to fuel shortages that were limiting the mining activities in the vicinity of the river. SCE began to investigate development of such a plant and signed an option to utilize river water for power generation. Engineers surveyed the Colorado River and a preferred dam site was selected, but at the time the technology to transport the power to the SCE's service area (a distance of 300 to 400 miles) at high voltages did not exist. Because of technological limitations and the decline in mining activity along the Colorado River, SCE abandoned this option (Myers 1983).

Throughout the next 20 years, development of a power generating facility on the Colorado River was discussed and debated by public and private power companies and the concept of the use of a dam was investigated to control the highly variable flows of the river. In 1921, SCE and U.S. Geological Survey engineers once again surveyed the river and throughout the 1920s, SCE filed licensing applications with the Federal Power Commission in an effort to obtain the right to construct dams and power generating facilities, but none were approved. In 1928, Congress passed the Boulder Canyon Act, which stipulated that the federal government would construct a dam on the Colorado River if public and private utility companies would take responsibility for the distribution of electrical hydropower. In 1930, SCE signed a contract stating that they would buy and distribute power for themselves and all other investor-owned utility companies. The Los Angeles Bureau of Power and Light agreed to purchase and distribute power for state and municipal utilities, as well as the metropolitan water district (Myers 1983).

Construction of Hoover Dam began in 1931 and was completed in 1935. Power production for use began in 1936 when power was delivered to the cities of Los Angeles, Pasadena, Glendale, and Burbank through three parallel transmission lines constructed by the Los Angeles Bureau of Power and Light (currently Los Angeles Department of Water and Power). The second company to distribute Hoover Dam power was the Nevada-California Corporation. The power was conveyed by a 132-kilovolt transmission line that had been originally constructed in 1930 and 1931 to deliver power to the dam site during construction. This transmission line is known as the Edison Company Boulder Dam-San Bernardino Electrical Transmission Line (Hatheway 2006; Hughes 1993; Myers 1983).

The Metropolitan Water District of Southern California was the next to distribute electrical power in 1938. This transmission line, known as the Metropolitan Water District Line, used technology similar to that used previously by SCE for 220-kilovolt transmission lines in southern California. Utility companies in southern California, such as the Pacific Light and Power Company (which merged with SCE in 1917) and SCE, were innovators in the development of high voltage systems. In 1926, Stanford University established a high-voltage laboratory and worked with Pacific Gas and Electric and SCE in research and development. Through this collaboration insulators for California's 220-kilovolt lines were developed (Hughes 1993; Myers 1983; Schweigert and Labrum 2001).

The SCE 220-Kilovolt North Transmission Line was constructed between 1936 and 1939, using the same design and technology SCE had been using for its high-voltage transmission lines in southern California (including its Vincent 220-kilovolt line), and the design used by the Metropolitan Water District for its Hoover Dam line. The transmission line was energized in 1939, after the completion of Hoover generating units A-6 and A-7 (Myers 1983; Schweigert and Labrum 2001).

When World War II began in Europe, SCE planners anticipated an increase in demand for power in southern California. SCE began construction on a second transmission line, the SCE South 220-Kilvolt South Transmission Line, in 1939. SCE North and SCE South take divergent courses from the SCE switchyard at the Hoover Dam, but meet near Hemenway Wash in Nevada, and run nearly parallel to each other from north of Boulder City, Nevada to Chino, California. SCE North and SCE South are parallel within the Calico Solar APE. Both SCE North and SCE South delivered electricity that was essential to war-time industries in Southern California. These industries included the Douglas, Vultee, and Northrup aircraft plants, Consolidated Steel, the Long Beach Naval Shipyard, Kaiser Steel, Alcoa, Columbia Steel, as well as automobile factories, tire plants, oil refineries, ordnance works, and military bases and depots (Myers 1983; Schweigert and Labrum 2001).

Natural Gas Pipelines

Two natural gas pipelines run through the Calico Solar Project APE — the Pacific Gas and Electric Pipeline and the Mojave Pipeline. Although it was known that natural gas could be used for fuel in the early years of the nineteenth century, it was not until 1859 when large amounts of natural gas were discovered in Titusville, Pennsylvania, that a commercial market for natural gas developed. Wide-spread use of natural gas began in the west when southwestern natural gas fields were discovered in the 1920s. Large natural gas fields found in the north Texas panhandle in 1918 and in Kansas in 1922, as well as the development of the technology needed to transport natural gas the long distances to urban areas, resulted in the development of the interstate gas pipeline industry (Castaneda 2001).

The Pacific Gas and Electric Pipeline on the Project Site is a 33-to-44-inch natural gas pipeline. The pipeline is an interstate pipeline that carries natural gas from the natural gas fields of Texas and New Mexico to Northern California. The 502-mile long pipeline was constructed in 1948, and at the time, was the largest pipeline in the country (PG&E Corporation 2004).

The Mojave Pipeline on the Project Site is a 24-inch natural gas pipeline, owned by El Paso Natural Gas Corporation, one of the largest natural gas companies in North America. The El Paso Natural Gas Corporation expanded their services into southern California in the 1940s in response to the post World War II population growth. The Mojave Pipeline is a 450-mile-long interstate pipeline that carries natural gas from Arizona to Kern County, California. It was constructed in the late 1940s (El Paso Corporation 2008; International Directory of Company Histories 1996).

While the modern practice of “monitoring” trenching for pipelines was not well-established at the time of the construction and installation of the PG&E and El Paso Natural Gas pipelines, subsequent surface surveys have not revealed negative impacts to cultural resources that are different from the range of site types and isolates identified during the survey for the Calico Solar project. A re-survey of the project is underway as this document is being prepared and this section will be updated in the future, if necessary.

Military Use

Several military bases are located in the Mojave Desert region and within the same region as the project, including Twenty-Nine Palms, south of the Calico Solar Project, and Fort Irwin, located approximately 37 miles northeast of Barstow. These, and other military installations in the area, led to an increase of traffic near the Project, and in the area population as civilians associated with the military took up residence.

During World War II, General George S. Patton established the Desert Training Center in California and Arizona, much of which was located on public land east of the Calico Solar Project APE. Training exercises were designed to prepare U.S. troops for combat in the hostile desert terrain and climate. The army established camps and emergency airfields, remnants of which can still be found, including rock alignments designating tent camps and emergency airfields. The Desert Training Center closed in 1944 toward the end of World War II. During desert training, the army created the first detailed maps of the Mojave Desert to facilitate training activities. The maps were created using aerial photography and land-based methods. After the war, those maps were used by the U.S. Geological Survey to create 15-minute topographic quadrangles in the late 1940s and early 1950s (Nystrom 2003). These training areas were located on public land east of the Project APE; there are no known desert training areas in the project vicinity.

Twenty years later, during the Cold War, the Mojave Desert in the vicinity of the Project again hosted a major training exercise. A training exercise, known as Desert Strike included troops from both the U.S. Army and Air Force and encompassed a 12 million-acre area in California and Arizona centered on the Colorado River. The two-week exercise was designed to test tactical deployment of nuclear weapons, and involved combat training between two hypothetical countries. Desert Strike occurred in May 1964 and resulted in the expenditure of approximately $60 million and 33 deaths (Garthoff 2001; Nystrom 2003; *Time Magazine* 1964).

C.3.4.6 CONCLUSIONS

Prior to arrival of Europeans and their diseases in California, the Calico Solar Project APE was inhabited for thousands of years by indigenous populations, as evidenced by multiple archaeological complexes of different cultural affiliations. During ethnographic times, the Serrano, Vanyume and the Chemehuevi inhabited the area. The project APE lies in a transitional zone near pluvial lakes, such as Troy Lake located to the west of the APE, which experienced episodes of inundations and desiccations. As a result it is unlikely that this area would have been suitable to support a large population for prolonged periods of time. Indigenous people traveling in this area adapted to these arid desert environments and managed successfully to exploit resources as is evident in the cultural materials they left behind.

During the Spanish and Mexican periods, San Bernardino County and the Project area remained relatively isolated. There were no Spanish and Mexican land grants in the region surrounding the project APE, and the Spanish were mainly interested in using the area as an overland route to their coastal missions. The Spanish explored and used the Mojave Trail trade route blazed by the Mohave Indians north of the project APE. This trail also was used by American explorers and mountain men who ventured into Mexican territory prior to the American period. The establishment of Fort Mohave on the banks of the Colorado River resulted in the use of the Mojave Trail as a wagon route, subsequently renamed the Mojave Road. This roadway was used as a travel and trade corridor until the railroad was constructed in the 1880s. After the railroad was built, travel through the Mojave Desert in the project vicinity shifted south into the project APE. In the early 1900s, a wagon road that had been constructed adjacent to the railroad began to be used by automobiles and was designed the National Old Trails Road. The National Old Trails Road was designed as U.S. Route 66 in the 1920s, and by the 1930s, its original alignment was abandoned in favor of the alignment of U.S. Route 66 to the south. In the late 1960s, I-40 was constructed along the north side of U.S. Route 66 in the Calico Solar Project APE.

During the American period, the area was not ranched or farmed due to arid conditions, though some attempts at cattle grazing have noted. Because of the arid conditions, the Calico Solar Project APE and its vicinity were used as a travel corridor rather than an area of settlement. Some mining activities occurred in the area, in particular manganese mining beginning in the 1940s. The area also was used as the setting for the Desert Strike military training exercises in 1964 and has been used as a corridor for electrical transmission lines and natural gas pipelines. Modern infrastructure in the project vicinity includes two steel tower transmission lines, wooden pole power lines, and underground pipelines along the south and east borders of Calico Solar Project. Radio facilities are also located south and east of the project.

C.3.4.7 CULTURAL RESOURCES INVENTORY

The analysis of the proposed action requires the development of a cultural resources inventory for the area where the action has the potential to disturb or destroy cultural resources. The development of the inventory has entailed the identification, description, and preliminary interpretation of the cultural resources in that area. More specifically, the effort to develop the inventory has involved a sequence of investigatory phases that includes background research, consultation with Native Americans and the broader public, primary field research, and the interpretation of the resultant information.

Investigation Context

The inventory effort for the Calico Solar Project began with the development of a geographic scope of investigation that would capture enough information to support a defensible cultural resources analysis. The scope of investigation for the proposed action includes considerations of both the geographic extent and the intensity of the geographic coverage of each investigation that contributes to the inventory effort. The geographic extent of the inventory investigations includes the different areas in which the proposed action has the potential to directly or indirectly effect cultural resources. The total of such areas is referred to as the “project area of analysis” or APE (see “The Project Area of Analysis and the Area of Potential Effects” subsection, above).

The cultural resources inventory for the current Calico Solar Project began with both background literature research and a field inventory of the entire APE. A subsequent third-party review of the archaeological inventory revealed that re-recordation of the resources identified during the field inventory would be necessary in order to provide a finer resolution of data that would better support this Staff Assessment. Staff made the decision to base this analysis on a 25% sample of archaeological sites identified during the initial inventory. This 25% sample was subject to the finer resolution re-recordation effort. As a result of the re-recordation work, the site forms were elaborated upon and updated, some sites were combined with others, some site boundaries were adjusted, and a few new sites were identified. The remaining 75% of the initial inventory will also be subject to the same finer resolution re-recordation effort; however, this work will be conducted following the decision on the project, along with all resource evaluation and mitigation investigations. Under these circumstances, a complex undertaking programmatic agreement (PA) is being prepared to adequately address the project's impacts to all cultural resources following approval of the proposed action for the Calico Solar Project, as described in detail below.

Complex Undertaking Programmatic Agreement for Section 106 Compliance

Concurrent with the discovery phase of the Energy Commission siting process, BLM and Energy Commission staff are developing an alternative approach to jointly satisfy NEPA, Section 106, and CEQA regulatory obligations. Energy Commission staff will participate in the development and execution of an agreement document that BLM staff will use to comply with Section 106, as well as to satisfy their obligations under NEPA, in order to consider the effects of the proposed action on cultural resources. The subject type of agreement document is known as a complex undertaking programmatic agreement (PA). The purpose of a complex undertaking PA is to afford a Federal agency (in this case, the BLM) a procedural mechanism to provide for the phased identification, evaluation and deferment of final evaluations for projects involving large land areas and corridors, as well as, the consideration and treatment of historically significant cultural resources when the effects of a proposed action on such resources, for different reasons, cannot be fully determined prior to the approval of that action. A complex undertaking PA is a document that sets out a regulatory process, which deviates from the standard Section 106 process and which addresses circumstances unique to a particular proposed action. The regulatory process set out in a complex undertaking PA is the result of negotiations among the lead Federal agency, other involved Federal agencies, the Advisory Council on Historic Preservation, the State Historic Preservation Officer, Native American groups, state and local governments, and the interested public. Such a regulatory process provides for the post-decision completion of steps in the standard Section 106 process that normally occur prior to a decision on a proposed action.

BLM and Energy Commission staff came to the decision to base the present cultural resources analysis on a statistically valid, 25% sample of the archaeological sites known from surface observation, as well as on 100% of built-environment resources and 100% of known ethnographic resources. BLM and Energy Commission staff believe that a controlled and well-documented 25% sample of the archaeological sites on the surface of the project APE, as well as what is known so far of the remaining 75% sample that will be subject to re-recordation, is a sufficient basis for a reliable assessment of the potential effects of the proposed action on that class of cultural resources and for the development of general processes and specific programs and protocols to resolve any significant effects that the analysis may identify. The proposed PA will, therefore, require the following:

1. Completion of the documentation for the remaining 75% of the surface archaeological sites in the project APE that are not part of the 25% sample discussed in this document
2. Final refinements to the 25% sample of surface archaeological sites discussed in this document
3. The implementation of a program to evaluate the historical significance of archaeological landscapes and districts, archaeological site types, and individual archaeological sites
4. Refinements to the character of the potential effects of the proposed action on different aspects of the archaeological resource base
5. Refinements to and the execution of multiple treatment plans to resolve those potential effects that are found to be significant

BLM and Energy Commission staff have concluded that the documentation of the 25% sample of the archaeological sites would serve as a major component of the present analysis and would be taken as sufficient to assess the potential effects of the proposed action on archaeological resources. The results of that effort therefore provide the basis of the analysis of the archaeological resource base in the present section.

This "Cultural Resources Inventory" subsection covers the methods and results of each phase of the background research and of the field investigations that have been conducted to construct a cultural resources inventory for the project area of analysis/APE. This subsection includes discussions of the archival research and the consultations that have taken place with Native American groups and the broader public about the project area of analysis/APE as a whole. This subsection will also provide discussions of the field investigations conducted to date for the project. The investigations include a geoarchaeological study of the project area, the pedestrian archaeological survey work conducted to date of the project area of analysis/APE, and the built-environment and ethnographic resource surveys. Separate subsections below explore the historical significance of the cultural resources found, assess the potential effects of the proposed action on significant cultural resources and on previously unidentified, buried archaeological resources, and propose mitigation measures for all significant effects.

Pre-Field Background Research

The background research for the present analysis employs information that the applicant and the BLM gathered from literature and records searches and information that the BLM and Energy Commission staff gathered as a result of consultation with local Native American communities and with other potential public interest groups. The purpose of the background information is to help formulate the initial cultural resources inventory for the present analysis, to identify information gaps, and to contribute to the design and the interpretation of the field research that will serve to complete the inventory.

Literature and Records Searches. On July 28, 2008, Robin E. Laska and Dustin Kay performed a records search at the San Bernardino Archaeological Information Center (SBAIC), which is the California Historical Resource Information System (CHRIS) cultural resources database repository for San Bernardino County. Ms. Laska searched all relevant previously recorded cultural resources and previous investigations completed for the Project area and a 1-mile search radius. Information included location maps for all previously recorded trinomial and primary prehistoric and historical archaeological sites and isolates, site record forms and updates for all cultural resources previously identified, previous investigation boundaries and National Archaeological Database (NADB) citations for associated reports, historic maps, historic addresses and resources listed on various state and federal inventories. These inventories included: the National Register of Historic Places, the California Register of Historical Resources, California Landmarks, California Places of Historic Interest, and others.

All previous cultural resource survey areas and all previously recorded cultural resource site locations were transferred to USGS 7.5’ quadrangles and later digitized into geographic information system (GIS) using ArcGIS 9.2 software. The following USGS quadrangle maps were used to this purpose; Hector (1982 Provisional), Lavic Lake (1955 Photorevised 1973), Sleeping Beauty (1982 Provisional Minor Changes 1993), Sunshine Peak (1955 Photorevised 1992), and Troy Lake (1982 Provisional Minor Changes 1993) (S.B.B.M). These data were combined with additional layers including topography, aerial photography and others.

Results of Prefield Research

Previous Investigations. According to the SBAIC and the San Bernardino County Museum, 18 cultural resource studies have been performed within the Project APE and within the 1-mile search radius surrounding the Project APE. Of these, one study occurs exclusively within the Project APE, eight occur within the 1-mile search radius, but not within the Project APE, and nine occur within both the Project APE and 1-mile search radius. The previous investigations examined less than 5% of the Project APE; therefore, the vast majority of the APE has not been previously investigated. The previous investigations within the Project APE and 1-mile search radius are summarized below in Table 2.

Cultural Resources Table 2
Previous Surveys in the Records Search Area

NADB No.	Investigation Type	Prepared By	Prepared For	Date Submitted
1060038	Positive Archaeological Survey	Simpson, Ruth D.		1958
1060047	Negative Archaeological Survey	Simpson, Ruth D.		1960
1060874	Positive Archaeological Survey	Barker, James P., Rector, Carol H., and Wilke, Philip J.	Archaeological Research Unit, UCR	1979
1060964	Positive Archaeological Survey	Norwood, Richard H.	Regional Environmental Consultants	1980

NADB No.	Investigation Type	Prepared By	Prepared For	Date Submitted
1060965	Negative Archaeological Findings	Musser, Ruth A.	Unknown	1980
1061449	Positive Archaeological Survey	Well, Edward B., Weisbord, Jill and Blakely	E.R. of Applied Conservation Technology, Inc.	1964
1061979	Positive Archaeological Survey	Fagan Bryan *et al.*	New Mexico University	1989
1062220	Positive Archaeological Survey	BLM	Bureau of Land Management	1978
1062234	Positive Archaeological Survey	Yohe II, Robert M. and Sutton, Mark Q.	California State University, Bakersfield –Cultural Resource Facility	1992
1062330	Positive Archaeological Survey	Simpson, Ruth D.		1964
1062388	Positive Archaeological Survey	McGuire, Kelly R.	Far Western Anthropological Research Group	1990
1062399	Positive Archaeological Survey	McGuire, Kelly R. and Glover, Leslie	Far Western Anthropological Research Group	1991
1062406	Positive Archaeological Survey	Osborne, Richard H.	California State University, Bakersfield –Cultural Resource Facility	1991
1062710	Positive Archaeological Survey	Apple McCorckle, Rebecca and Liliburn, Lori	Dames and Moore	1993
1062808	Positive Archaeological Survey	Padon, Beth and Breece, Ladurel	Southern California Gas Company	1993
1062862	Positive Archaeological Survey	Apple McCorckle, Rebecca	Dames and Moore	1993
1063630	Negative Archaeological Survey	Budinger, Fred	Tetra-Tech	2001
1063631	Positive Archaeological Survey	Clark, Caven	ACS Limited	1998

Previously Recorded Cultural Resources. A total of 78 cultural resources have been previously recorded in the APE and 1-mile search radius (Table 3). Forty-two of these resources are archaeological sites, 28 are prehistoric isolates, and nine are historic-era resources (two of which are built-environment). Sixteen of the cultural resources occur within the Project APE (1 isolate, 13 prehistoric sites, and 2 historic sites); 63 occur within the 1-mile search radius (32 isolates, 29 prehistoric, and 2 historic sites), and three sites occur in both the APE and the 1-mile search radius (1 prehistoric site, and 2 historic sites) (Confidential Appendix E, Cultural Resources).

Two of the previously recorded sites, SBR-2910H and SBR-6693H, both of which are located within the 0.5-mile built-environment APE, are listed as eligible for the National Register Historic Places (NRHP). **SBR-2910H** is the National Old Trails Road/U.S. Route 66, which varies from a graded dirt road to a two-lane paved road. Historic trash scatters are found sporadically along the road consisting of historic glass, cans, signs, and car parts. This highway represents one of the earliest trans-continental automobile routes. Between 1990 and 1998 portions of this site were given status codes 2S2 (individual property determined eligible for the NR [National Register] by a consensus through Section 106 process; listed in the CR [California Register]) and 2S (individual property determined eligible for the NR by the Keeper; listed in the CR.) This resource is within the 0.5-mile built-environment APE for the Calico Solar Project – Phase 2.

SBR-6693H is the railroad line that was originally built in 1883 for the Atlantic and Pacific Railroad Company. From 1890, the railroad was operated by the Atchison, Topeka & Santa Fe Railroad until its merger in 1996 with the Burlington Northern Santa Fe Railway. In addition to the railroad track, associated historical artifacts include glass, metal, track and train parts, and railroad tableware. Between 1993 and 2002 portions of this site have been given status codes 2S2 (individual property determined eligible for the NR by a consensus through Section 106 process; listed in the CR) and 6Y (determined ineligible for NR by consensus through Section 106 process, not evaluated for CR or Local Listing). SBR-6693H bisects the Calico Solar Project APE and is located within the 0.5-mile built environment APE for both phases and within the Pisgah Triangle study area.

Cultural Resources Table 3
Previously Recorded Cultural Resource Sites
in the Project APE and One-Mile Radius

Primary	Trinomial	Site Type	Dimensions
36-061410		Black on white pottery sherd	NA
36-061415		Isolated jasper flake	NA
36-061416		Two isolated chalcedony flakes	NA
36-061417		Isolated chalcedony flake	NA
36-061420		Isolated chalcedony flake and isolated rhyolite flake	NA
36-061421		Isolated jasper flake	NA
36-061423		Isolated cryptocrystalline flake	NA
36-061424		Isolated white cryptocrystalline flake	NA
36-061425		Isolated white cryptocrystalline flake	NA
36-061426		Isolated red cryptocrystalline flakes	NA
36-061427		One isolated red cryptocrystalline flake tool and one red cryptocrystalline flake	NA
36-061428		Two isolated cryptocrystalline flakes	NA
36-061429		Isolated cryptocrystalline silicate flake	NA
36-061430		Isolated cryptocrystalline silicate flake	NA
36-061431		Isolated cryptocrystalline silicate flake	NA
36-061432		Isolated cryptocrystalline silicate flake	NA

Primary	Trinomial	Site Type	Dimensions
36-061433		Isolate: Two isolated cryptocrystalline silicate flakes	NA
36-061434		Isolated cryptocrystalline silicate flake	NA
36-061435		Isolated cryptocrystalline silicate flake	NA
36-061436		Isolated cryptocrystalline silicate flake	NA
36-061459		Isolate: 3 cryptocrystalline flakes	NA
36-061460		Isolate: One multidirectional core and 1 flake of same material	NA
36-061461		Isolate: One red cryptocrystalline flake	NA
36-064406		Isolated chert flake and one piece of angular waste	NA
36-064407		Two isolated chalcedony flakes	NA
36-064408		Isolated red jasper flake fragment	NA
36-064409		Isolated agate bifacial core	NA
36-064410	Relocated CA-10649	One isolated red jasper flake and a second flake with dorsal scars	NA
	CA-SBR-1585	Small lithic test and quarry area with flakes and one core	NA
36-001585	CA-SBR-1793	Also known as EM-266, this is a Petroglyph Site	NA
	CA-SBR-1889	Pottery sherds, awl, 2 bifaces	NA
	CA-SBR-1893	Lithic scatter containing mutates, projectile points and debitage	NA
	CA-SBR-1905	Also known as SBCM 674, this site consists of 2 projectile points, scrapers flakes and bone which were collected at time of recordation	NA
	CA-SBR-1907	Jasper quarry with sparse scatters consists of flakes, bifaces and scrapers	NA
	CA-SBR-1908 Relocated	Large quarry area containing debitage, cores and bifaces	NA
	CA-SBR-1988	Low density; sparse cobble testing/ quarry area consisting of cryptocrystalline silicate, basalt and rhyolite materials.	NA
	CA-SBR-2330H	Flaking stations with at least 11 loci and two cleared circles	NA
	CA-SBR-2910H Relocated	Lavic Chinese Labor Camp, Glasgow pottery along with hearths was recorded next to the Santa Fe Railroad near Lavic Siding. Built Environment? National Old Trails Road?	NA
	CA-SBR-3515H	Built Environment: Also known as National Old Trails Highway 66/ SM364. This is an early 20th century two-lane paved road at Mile Post 183 where it becomes a graded dirt road.	NA
	CA-SBR-3516	Two rock rings, it was not determined if they were historic or prehistoric	NA

Primary	Trinomial	Site Type	Dimensions
	CA-SBR-3076	Lithic quarry site containing flakes and cores of chert material and historic trash scatter	NA
	CA-SBR-4307	Two rock circles made of volcanic basalt	NA
	CA-SBR-4308	Several lithic scatters	NA
	CA-SBR-4309	Two lithic reduction stations that contain flakes and cores	NA
	CA-SBR-4405	Lithic scatter with a lithic reduction station. Possible basalt and andesite tools present on site.	NA
	CA-SBR-4558H Relocated	Built Environment?: A booth and cargo loading platform located where the railroad splits.	NA
	CA-SBR-4681H Relocated	Also known as SBCM 4918, This site is a 1930s and 1940s manganese mining area containing a galvanized steel structure, mill tailings, mine and historic trash scatters	NA
	CA-SBR-5600 Relocated	Lithic scatter	NA
	CA-SBR-5598	Lithic reduction station	NA
	CA-SBR-5599	Large cobble test/quarry area	NA
	CA-SBR-5794	Lithic scatter and rock rings	NA
	CA-SBR-5795	Cobble quarrying and lithic reduction area	NA
	CA-SBR-5796 Relocated	Lithic scatter originally containing 100s of flakes, several biface fragments and cores	NA
	CA-SBR-5797	Low density lithic scatter containing flakes and cores	NA
	CA-SBR-6511 Relocated	Low density lithic scatter with dozens of flakes and cores	NA
	CA-SBR-6512 Relocated	Very large low density lithic scatter containing debitage and shatter	NA
	CA-SBR-6513 Relocated	Also known as MP-26, this is a small low density lithic scatter that contains debitage	NA
	CA-SBR-6517	Also known as MP-27, this is a single segregated lithic reduction locus containing approximately 15 felsite flakes total	NA
	CA-SBR-6518	Small flake scatter with one core and 8 flakes	NA
	CA-SBR-6519	Small cobble test and quarry area with 2 Segregated Reduction Loci and debitage	NA
	CA-SBR-6520 Relocated	A single Segregated Reduction Locus made up of approx. 4 flakes	NA
	CA-SBR-6521 Relocated	Small cobble test and quarry area with one Segregated Reduction locus and debitage	NA
	CA-SBR-6522	Low density cobble test and quarry area with debitage, cores, bifaces and blanks	NA

Primary	Trinomial	Site Type	Dimensions
	CA-SBR-6525	Low density cobble test and quarry area with debitage, cores, bifaces and blanks	NA
	CA-SBR-6526	Also known as MP-84, this is a low density lithic scatter that contains 1 lithic reduction locus flakes and debitage	NA
	CA-SBR-6527	Also known as MP-85, this site contains 2 adjacent lithic reduction loci and flakes	NA
	CA-SBR-6528 Relocated	Also known as MP-86, this site is a small low density flaked stone scatter	NA
	CA-SBR-6693H-NRHP Relocated	Also known as MP-87, this is a small density lithic scatter Built Environment/Railroad?	NA
	CA-SBR-6786H	Built Environment?: Railroad Line built in 1883 for the Atlantic and Pacific Railroad Co., associated artifacts include track and train parts, railroad tableware, and insulator glass fragments	NA
	CA-SBR-6836	Cobble quarrying area comprised of approx. 200 flakes and 4 cores	NA
	CA-SBR-6895	Small lithic scatter containing approx. 6 jasper flakes	NA
	CA-SBR-6896	Single Segregated Reduction Locus containing flakes	NA
	CA-SBR-6897	Small, sparse lithic scatter consisting of 13 flakes, no tools	NA
	CA-SBR-6898	Small moderately dense lithic scatter consisting of approx. 20 cryptocrystalline flakes.	NA
	CA-SBR-7114	Cryptocrystalline lithic scatter with over 50 flakes and 4 bifaces.	NA
	CA-SBR-7115	Moderately dense lithic scatter with 51 cryptocrystalline flakes representing all stages of reduction.	NA
	CA-SBR-7116	Very sparse lithic scatter along lava ridges	NA
		Possible pot hunter deposit, several flaked litchis in small cluster	NA

NA: Not available

Discussion of Previously Recorded Resources within the APE.

CA-SBR-10649H is a very small prehistoric lithic test quarry/scatter containing at least four chert/jasper flakes, 1 white chert core and 1 volcanic core. The site is located atop a sandy clay and disturbed desert pavement terrace with an open exposure and 0° degree slope. The site was recorded by Stephanie Rose and Iain Berdzar of Tierra Environmental Services in February 2001.

CA-SBR-1896 is a prehistoric lithic scatter containing fire stones and projectile points. The site was recorded by Lyle Richards, date unknown.

CA-SBR-1908 is a very large low density prehistoric cobble test/quarry area, measuring 115 m N/S × 95 m E/W. Raw materials consist of cryptocrystalline silicate, basalt and rhyolite materials. The site is most dense at the top of the hill at mile post 157. Site was originally recorded in 1965 by an unknown person and updated by J. Berg of Far Western Anthropological research Group, Inc. in November 1989. During the survey done by Far Western the site was tested. A total of eight 25 × 50 cm test units were excavated finding only one flake in STP#2. In February 2001 the site was updated by J. Dietler and J. Toenjes of Tierra Environmental Services. The condition of the site was considered the same as 1989 and no further description was provided.

CA-SBR-4558H also known as SBCM 4918. This is a 1930s and 1940s historic manganese mining area containing a galvanized steel structure, mill tailings, mine and historic trash. The site is situated on the south side of the Cady Mountains and approximately 5 miles north of Pisgah along the Santa Fe Railroad. The site was by R. Brooks of BLM during October 1979.

CA-SBR-4681 is a prehistoric lithic scatter located atop an undisturbed alluvial bench. Lithic materials consist of a few relatively fresh basalt flakes and cryptocrystalline silicate jasper flakes. Some of the weathered basalt artifacts resemble the “Malpais” Complex. The site was recorded by Hardaker and Musser of BLM in January 1980.

CA-SBR-5600 is a prehistoric lithic reduction station located atop a desert pavement knoll. Raw materials consist of cryptocrystalline silicate (jasper) and basalt. The site has two components; one cryptocrystalline silicate jasper flaking station, and another consisting of basalt flakes with no evidence of ware. The site was recorded by Hardaker and Musser of BLM in January 1980.

CA-SBR-5796 is a prehistoric low density lithic scatter located in a bajada bisected by an alluvial wash. The site was originally recorded by J. Wollin of the New Mexico State University in 1985. During the survey there was lithic surface collection and testing; artifacts included dozens of flakes, mostly primary and several cores. Materials included cryptocrystalline silicate (jasper, chert, and chalcedony) and basalt. The site was updated in February 2001 by J. Dietler and J. Toenjes of Tierra Environmental Services. During the update a lithic scatter was observed.

CA-SBR-6511 is prehistoric low density lithic scatter measuring 40 m E/W × 50 m N/S. The site situated on a large alluvial plain in an area of moderately consolidated desert pavement mixed with areas of loose sandy soil. Materials include cryptocrystalline silicate and rhyolite. The site was tested; eight 25 × 50 test units were excavated in the portion of the site which will be impacted by the Mojave Pipeline. The site was recorded by L. Glover *et al.,* of Far Western Anthropological research Group, Inc. in November 1989.

CA-SBR-6512 is a prehistoric small density lithic scatter of mixed materials that is situated on the slope of a small sand dune which was built up along the side of a small lava flow. The site measures 20 m E/W × 11 m N/S. Raw materials include cryptocrystalline silicate, basalt and rhyolite. The site was recorded by L. Glover *et al.,* of Far Western Anthropological research Group, Inc. in November 1989.

CA-SBR-6513 is a prehistoric single segregated reduction locus located on unconsolidated desert pavement at the base of a small lava flow, that measures 2.4 m E/W × 1.4 m N/S. The SRL consists of approximately 15 felsite flakes. No tools are associated. The site was recorded by L. Glover *et al.,* of Far Western Anthropological research Group, Inc. in November 1989.

CA-SBR-6520 is a prehistoric small low density cobble test/quarry area consisting of one segregated reduction locus, one cryptocrystalline silicate core and approximately 16 additional pieces of debitage. The site measures 67 m NW/SE × 20 m SW/NE. Raw materials are cryptocrystalline silicate and basalt. The site was recorded by L. Glover *et al.,* of Far Western Anthropological research Group, Inc. in November 1989.

CA-SBR-6521 is a prehistoric low density desert pavement cobble test/quarry area site, measuring 135 m N/S × 70 m E/W. Raw materials consist of cryptocrystalline silicate, basalt, and rhyolite. The site is essentially an area of primary reduction with a few first stage bifaces. The site was tested; four 25 × 50 cm test units were excavated. Artifacts found consist of 4 bifaces, 4 cores, and 1 flake; the debitage came from reducing on site cobbles in pavement formation. No artifacts were collected.

The site was recorded by L. Glover *et al.,* of Far Western Anthropological research Group, Inc. in November 1989.

CA-SBR-6528 is a prehistoric small low density lithic scatter consisting of 10 flakes of reddish/brown/purple cryptocrystalline silicate. The site measures 17 m E/W × 14 m N/S. Tools found within the site consist of one bifacial core, one multi-directional cryptocrystalline silicate core and debitage. The site was recorded by Mikkelsen *et al.,* of Far Western Anthropological research Group, Inc. in November 1989.

CA-SBR-6693H-NRHP was originally recorded by Michael Lerch in 1990, who describes the railroad as having originally been built “in 1883 for the Atlantic and Pacific Railroad Co. by Southern Pacific, and subsequently purchased by the Atchison, Topeka & Santa Fe railroad, which has operated it since 1890. In 2001, Tierra Environmental Services updated the site stating that the railroad is currently operated by the Burlington Northern and Santa Fe Railroad Co. A wooden phone/telegraph line with two cross pieces with glass insulators and two wires paralleling the tracks were found. Other artifacts were found, such as track and train parts, railroad tableware, and insulator glass fragments.

C.3.4.8 CONSULTATIONS

Native American Consultation

With the filing of the application for a right-of-way, BLM took the lead for formal tribal consultation pursuant to the National Historic Preservation Act as well as other laws and regulations. The BLM initiated formal government-to-government consultation in the early stages of project planning by letter November 5, 2008 and has followed up with an additional letter and other information since then. To date, eight tribes have been identified and invited to consult on this project. A general informational meeting about the project was held on November 10, 2009. The BLM has responded to three requests for formal meetings with tribes the San Manuel Band of Mission Indians, Twentynine Palms Band of Mission Indians, and the Chemehuevi Reservation and have received some written comments from tribal governments.

Other Consultation

The ACHP, the CA SHPO, and the project proponent are all organizations or agencies that will be invited into consultation on the development of the Programmatic Agreement. Those consultations are ongoing.

C.3.4.9 NEW INVENTORY INVESTIGATIONS

Geoarchaeology Study

Except for minimal editorial contributions, the following subsection was adapted from "**Geoarchaeological Sensitivity Analysis of the Solar One Project Area" by** Jay Rehor, M.A., RPA taken from Solar One ***Data Response 92/93.***

Background and Setting

The purpose of the Geoarchaeological study was to….The following discussion is largely focused on identifying those portions of the project area that have the potential for harboring archaeological deposits *with no surface manifestation*. It has been shown that some alluvial landforms, with desert pavements that have evolved through accretion of eolian silts and sands and the gradual bearing of larger clasts to the surface, have the potential for containing buried archaeology (Ahlstrom and Roberts 2001). However, a representative portion (if not the vast majority) of this archaeological deposit will be incorporated into the surface pavement through the same accretionary process. Thus, these older surfaces are not likely to contain archaeology that is not at least partially evident on the surface.

Geomorphic processes have played a major role in the differential preservation of archaeological sites in the Mojave Desert. For example, early cultural sites related to the San Dieguito and Lake Mojave cultural complexes are almost exclusively known from surface contexts on terminal Pleistocene and early Holocene geomorphic surfaces (Sutton 1996:229). This represents the differential preservation of older sites on relict landforms, with other sites likely buried by subsequent depositional processes, or destroyed by erosional processes. These same processes have also affected the distribution of resources (i.e., lithic raw material, water, biotic communities, etc.) across the landscape and, thus, the placement of archaeological sites in relationship to those resources. The primary factors effecting geomorphic processes in the Mojave region are the underlying structural geology and climate change.

Regional climatic trends through the Late Pleistocene and Holocene are important to the current study because of effects on the production of material for alluvial deposition and the concomitant susceptibility of the landscape to erosion. Regional correlations between periods of alluvial fan deposition during the Latest Pleistocene and Holocene indicate that climatic changes superseded other factors as the primary force driving alluvial deposition (McDonald, McFadden, and Wells. 2003:203). Within the Mojave Desert, several major intervals of alluvial deposition have been identified and appear roughly correlative across the region, largely transcending geomorphic variation (Anderson and Wells 2003; Harvey and Wells 2003; McDonald, McFadden and Wells 2003).

In general, the Pleistocene-Holocene transition ca. 13,000 to 9,000 years before present (BP) represents a major period of fan deposition, followed by subsequent periods during the Holocene at approximately 8,000 to 5,000 BP, 4,000 to 3,000 BP (both corresponding with brief resurgences of Lake Mojave), and after approximately 1,500 BP. It was initially conjectured that these periods, especially around the Pleistocene-Holocene transition, correlated with general environmental desiccation, a decrease in soil moisture and vegetation, and an increase in sediment supply and erosion (e.g., Bull 1991; Wells et al. 1987). However, recent field studies have demonstrated that changes in vegetation cover alone do not explain increased sediment mobility. Instead, the most plausible hypothesis points towards a northward shift in the dominant late summer/early fall jet-stream, allowing tropical Pacific cyclones from southern Mexico into the region and causing unusually large amounts of precipitation over short periods (McDonald, McFadden and Wells 2003:202).

Pollen and lake level records suggest general trends in late Pleistocene and Holocene climate change, but these records do not make clear what meteorological changes are responsible for the trends. Pleistocene climate was wetter and cooler than today, with extensive lakes (including Troy Lake, several miles west of the Calico Solar project area), and pinion-juniper woodlands extending into much lower elevations (Spaulding 1990). The vegetation transition from the Pleistocene through early Holocene appears to have been relatively gradual, with woodlands retreating and giving way to desert scrub. During the middle Holocene (ca. 8,000 to 4,000 BP) climate appears to have been generally warmer and drier than today, but with some indications of significant oscillations in climatic patterns (Spaulding 1990), possibly akin to those suggested by McDonald, McFadden, and Wells (2003) and responsible for the middle Holocene Qf3 fan deposition in the Soda Mountains. The late Holocene climate was generally similar to modern conditions. However, given the higher resolution record for this more recent period, it appears that several periods of extended drought (including the Medieval Climatic Anomaly, ca. 1150 to 600 BP) as well as at least one cooler wetter period (the Little Ice Age, ca. 600 to 150 BP; Grove 1988) marked the late Holocene.

Periodic increases in effective moisture likely resulted in higher seasonal wash flow, improving the exploitable habitat for human residents, and accelerating the geomorphic processes that led to the burial or erosion of archaeological sites. These climatic changes also increased the sediment supply available for wind-blown (eolian) transport on dry lake beds and former stream channels during intervals of decreased effective moisture. Eolian processes deflated sediment source areas and deposited that material elsewhere. Taken together, these processes created, destroyed, and buried landforms that humans may have occupied across the Mojave Desert.

In additional to climate, tectonics play a less active but equally important role, through the uplift of remnant landforms and the exposure of raw materials (lithics) for human use. At least two strands of the Alquist-Priolo Fault Zone run through the southern portion of the project area, and have caused noticeable uplift and preservation of relict landforms. In addition, volcanic activity, which is inherently linked to tectonics, has had a dramatic effect on the geomorphic development of the project area.

Identification of Major Landforms within the Project Area

The Calico Solar Project study area is bounded to the north and east by the granitic/ quartz monzonite/basaltic pluton that forms the Cady Mountains, and to the south by the Pisgah Lava flows. The rock outcrops of the Cady Mountains are heavily eroded and mantled by Quaternary fan piedmonts, with more recent fan aprons issuing from the leading edge of these piedmonts. Alternatively, the Pisgah Lava flows have largely created a barrier to the introduction of more recent alluvial material from the mountains and fans to the south, and have served to preserve older deposits at the surface. All of these Quaternary landforms are actually comprised of numerous remnants and more recent deposits of varying ages. By examining the relationship between the landform components we can develop relative age estimates, conclusions as to the depositional history of that landform, and the potential of each landform to harbor buried paleosols of appropriate age.

Before beginning such a discussion, however, a common set of descriptive landscape terms and definitions is necessary. Many different terms are used to describe desert geomorphology, with vastly different implications of scale, accuracy, and implied formation processes. “Alluvial fan” and “bajada” are two common terms that are often misleading because they are used to refer to different types of depositional and erosional landscapes and subsume numerous smaller landform components. The terminology adopted in this study follows after Peterson (1981) because the classification system emphasizes the temporal and spatial relationship between landform components, and was devised in relation to the study and classification of Basin and Range soils− making it highly relevant to the current geoarchaeological study. A discussion of these various landforms is provided in the following sections, with direct reference to the Calico Solar study area.

At the broadest scale, the Calico Solar study area — including the surrounding piedmonts to the north, east, and south — can be classified as a “semi-bolson.” Common in desert regions of the Basin and Range, semi-bolsons differ from true bolsons in that they lack a playa or floodplain, which alluvial fans normally terminate on, and instead are cut through by an axial drainage that marks the termination of the various piedmont landforms. The Calico Solar project area is similar to portions of the semi-bolson in that it lacks many of the distinct depositional features of the larger down-stream axial channel (e.g., terrace, floodplain). The typical axial channel eventually opens out into a true bolson and associated playa. In the case of the Calico Solar study area, this is represented by Troy Lake, several miles west of the project area near the western extent of the Cady Mountains.

The Calico Solar project area semi-bolson can be further divided into two dominant structural sections. The larger of these consists of the Cady Mountains and associated coalescing alluvial fan piedmont — gradually sloping down to the southwest — that dominates the northern approximately 2/3 of the project area. The second structural section is formed by several different component landforms that are generally lower but more topographically diverse, including the Pisgah Lava flows (functionally related to the Lava Bed Mountains, further to the south), several old remnant fans, inset fans, and associated alluvial flats. These northern and southern sections are divided by the axial channel, which runs roughly east–west, and which has likely been significantly altered by the Burlington Northern Santa Fe rail line that generally follows the same course.

The combined results of this study are summarized in Table 4. The following is a discussion of these results.

Cultural Resources Table 4
Summary of Geoarchaeological Sensitivity of Landforms within the Calico Solar Project Study Area

Area	Landform	Age	Depositional Regime*	Sensitivity
Northern Section	Rock Outcrops	Tertiary or older	Erosional	None
	Upper Alluvial Fan Piedmont	Pleistocene to Mid-Holocene	Erosional	Very Low
	Lower Alluvial Fan Apron	Pleistocene to Holocene	Variable	Low
Southern Section	Pisgah Lava	Late Pleistocene	Stable	None to very low
	Erosional Fan Remnant (fanglomerate)	Pleistocene	Erosional	Very Low
	Inset Fans	Pleistocene to Holocene	Variable	Very Low to Low
	Relict Alluvial Flat	Pleistocene (?)	Erosional (variable)	Very Low
	Axial Channel (and associated minor landforms)	Late Holocene	Variable	Very Low to Moderate

*Represents the dominant regime since the terminal Pleistocene

Northern Section. The northern portion of the study area is the simpler of the two. This area consists of a fan piedmont that is comprised of numerous coalescing alluvial fans issuing from the mouths of small mountain valleys within the Cady Mountains. The piedmont is composed of the upper alluvial fans themselves, as well as more recent fan aprons at lower elevations. The surfaces of these landforms typically consist of numerous active and abandoned channels and intervening surfaces that range from Early Pleistocene to Holocene in age (Dohrenwend et al. 1991:327). Given the punctuated deposition and erosion of these landforms during the Holocene, however, the archaeological record represented on these landforms may be incomplete.

The most distinct, well-developed desert pavement observed on the alluvial fan piedmont is located in the northeast portion of the piedmont, which has the largest proportion of andesite bedrock (Dibblee 2008). This andesite is generally more resistant than the coarse grain granite and monzonite, and appears to form a more distinct varnish. Given the predominance of granitic parent material, we can expect that desert pavements within the northern portion of the project area will generally be much weaker than in other areas of the Mojave Desert, where more resistant parent material may be present (including the southern portion of the project area). Additionally, comparison of pavement surfaces within the project area may be tenuous, especially between the northern and southern portions, which consist of very different parent materials and geomorphic histories. While a well-developed pavement is invariably indicative of an old land surface, a poorly developed pavement is not inherently young. None the less, an initial field reconnaissance, and a general understanding of the development of alluvial fans within the Basin and Range, suggested that the majority of surfaces within the northern fan piedmont are late Pleistocene to Holocene in age. Given these constraints, an examination of subsurface conditions was considered necessary to evaluate landform ages and to determine the potential for buried archaeological deposits.

- **Rock Outcrops** (Sensitivity: None). At the higher reaches of the piedmont (the northern extent of the project area), rock outcrops are present. These are limited exposures of highly dissected Tertiary andesite and basalt bedrock which form steep, highly-eroded hills (inselbergs) sticking up out of the alluvial fans (Dibblee 2008). While these limited andesite and basalt outcrops provide some of the parent material that make up the alluvial fans, the vast majority appears to be granite and quartz monzonites, which also form the majority of the southern Cady Mountains and into which extend the mountain valleys that transport the material that forms the alluvial fans (Dibblee 2008). Of course, these rock outcrops have little or no potential for harboring buried archaeological deposits.
- **Upper Alluvial Fan Piedmont** (Sensitivity: Very Low). In general, there appears to be a trend of decreasing sediment size as one moves downslope along the piedmont gradient. This is typical of alluvial fans, with bouldery material near the fan head and fine sands at the distal toe (Peterson 1981:22). Test pits and borings within the northern portion of the Calico Solar project area (e.g., TP 016, 026, 027, and 040 through 047) consistently revealed profiles dominated by angular to sub-angular cobbles and gravels, with a clast supported matrix of sandy loam. Different weathering profiles laterally (east–west) across the piedmont indicate that the various fans that make up the piedmont are of different ages– as is expected given the results from other mountain fronts in the Mojave Desert (e.g., Bull 1991; Eppes, McDonald, and McFadden 2003; McFadden and Wells 2003). However, no buried soils were identified and the very coarse clast size indicates a very high-energy colluvial/debris flow depositional environment that precludes the preservation of paleo-surfaces and associated archaeological remains.

  The oldest major alluvial fan structure on the piedmont appears to be located along the eastern boundary. Very well-developed varnish and rubification on the desert pavement in the upper portion of the fan, and well-developed subsurface weathering profiles throughout the fan suggest a late Pleistocene age or older. The subsurface profile exhibits very strong pedogenic development, with an upper vesicular horizon, a Btk-horizon with strong reddening (5YR 5/4), and multiple calcic horizons, the strongest exhibiting Stage IV cementation. Coarse high-energy angular and sub-angular colluvial/debris flow material is apparent throughout the profile, and is consistent with other profiles observed across the upper fan piedmont.

  The lithology of the northern coalescing fan piedmont is important for two reasons: the parent material of the alluvial fans directly affects the ability of distinct desert pavements to form and, thus, determination of surface age (as discussed above);

and it dictates the availability of usable lithic raw materials for prehistoric populations. Coarse grained granites and monzonites have very little utility as a raw lithic material, as they are not appropriate for flaked stone tool industries, and are similarly difficult to use as groundstone due to their coarse grain and friable nature. The predominance of this parent material may largely explain the dearth of prehistoric archaeological sites on older alluvial fan segments within the northern portion of the project area. This same reasoning would further reduce the potential for buried archaeological resources with the fan piedmont (including the lower fan aprons, see below). In conjunction with the lack of identified paleosols and the consistently high-energy subsurface deposits, the sensitivity for buried archaeological deposits within the upper alluvial fan piedmont is considered very low.

- **Lower Alluvial Fan Apron** (Sensitivity: Low). The finer grain material that dominates the lower portions of the fan piedmont, the near absence of well-developed pavement surfaces, as well as the geomorphic structure– with countless small anastomatizing channels and distinct bar and swale surface morphology– are all typical of fan aprons. However, the topographical continuity between the upper and lower portions of the piedmont is atypical of alluvial fans and their associated younger aprons (Peterson 1981:22-24) and raises questions about the functional relationship and timing of deposition between the upper alluvial fan and the lower aprons. Is the surface morphology and grain size differentiation between the two portions of the fan piedmont a result of timing (i.e., the upper surfaces are older and had time to develop pavement surfaces), or a result of natural clast sorting (i.e., coarse grain material naturally settles-out up-slope, with progressively finer material as one moves down gradient)? The apparent young age of the lower apron surfaces is an initial indicator of their potential to harbor buried archaeological deposits. However, further investigations indicate that there is a low geoarchaeological potential due to the nature of their geomorphic evolution.

  Powell states that younger alluvial fan aprons often “bury or feather out onto older fans distally” (2002:16). Thus, this middle and lower portion of the northern fan piedmont has undergone deposition (and erosion?) since the earliest documented human occupation of this area. Therefore archaeological sites in this portion of the project area have been removed by erosion or may remain buried under these younger fan deposits. Along the eastern alluvial fan piedmont at Clark Mountain, in the northeastern Mojave, it was demonstrated that major progradation of the fan aprons occurred between 8,000 and 4,000 BP, followed by a switch to an erosional regime during the late Holocene. It was conjectured that this transition was due to a reduction in available sediment for deposition (CH2MHill 2008). After an initial erosion of the uplands, fluctuating precipitation and sediment-starved runoff eroded recently deposited material on the lower hill slopes. The middle and lower portion of the Calico Solar alluvial fan piedmont, dominated by fan aprons, is not a stabilized surface. Recent landforms such as bar and swale topography, countless small anastomatizing gullies, and larger channels extend across most of this area and indicate ongoing desiccation and active erosion.

  Buried pedogenic horizons were identified in numerous test pits and borings within the apron portion of the northern fan piedmont. The nature of these contacts are indicative of the initial formation of the lower piedmont and suggests that deposition is typically preceded by significant erosion. The upper unit consists of a single fining upward sequence dominated by coarse sub-angular gravels and cobbles at its base, and sandy loam with few gravels near the surface. This suggests that this portion of the fan apron was formed as a single depositional package, likely during the middle or late Holocene. However, the coarse material at its base, and the very distinct lower erosional contact, indicate that initial deposition of the apron was relatively high-energy and preceded by significant erosion. The lower buried pedogenic unit has a Btk-Bkm-Bk-Ck-C profile, consistent with a Pleistocene age and a truncated upper profile.

The upper unit consists of an Av-Bwk-Ck-C profile that is better developed, with a maximum of Stage I+ to II carbonate development, and consistent with a middle Holocene (?) age. Note that the surface pavement is only slightly more distinct than the preceding example, despite the apparent pedogenic age difference. The surface is more accurately described as stony, with no varnish and only very minor rubification on the ventral surfaces of surface clasts. Again, this unit has coarse angular debris flow-type gravels at its base, and a distinct erosional contact with the underlying paleosol. However, rather than being a single depositional unit, the upper apron mantle appears to be composed of at least three lithologic units, each represented by a fining upward sequence. The continuous weathering profile across these lithologic contacts indicates that they were deposited in relatively rapid succession, with no periods of stability which would have formed individual pedogenic profiles. The lower buried pedogenic unit has a Km-Bkm-Bk-Ck-C profile, again, consistent with a Pleistocene age and an even more heavily truncated upper profile.

Although distinct very old paleosols, buried below recent alluvium, were consistently identified within the lower portions of the alluvial fan piedmont, they are marked by heavily erosional upper contacts. It appears that significant erosion occurred prior to deposition of the fan apron mantles. This erosion would have destroyed any archaeology deposited on these older (now buried) surfaces, and effectively nullifies the potential for buried archaeology within the middle and lower portions of the northern fan piedmont. The presence of more recent lithologic contacts indicates that the fan aprons were sometimes formed through multiple depositional events, but the lack of identifiable paleosols at these contacts suggests that they were laid down more-or-less contemporaneously and, therefore, have a low archaeological potential.

Southern Section. The southern portion of the study area is comprised of generally older and more variable landscape elements compared to the northern portion. While also considered a piedmont, the southern area appears to be generally much older, comprised of numerous relict landforms, with differing source material and component landforms.

An initial clue to the age of the landforms of the southern area is provided by the Pisgah Lava flow. This flow is generally considered to have erupted in a series of closely related events ca. 20,000 BP.[2] The Pisgah lavas overlie numerous deposits just south of the study area, including the older alluvial sediments (Qoa), fanglomerate (Qof), and

[2] Sylvester et al. (2002) place the timing of the eruptions at 18,000 ±5,000 BP based on argon-argon dating, whereas Phillips (2003) obtained a date of 22,500 ±1,300 BP based on cosmogenic ^{36}Cl analysis. These dates are within the expected range, of a few thousand years, for the multiple flows issuing from the Pisgah crater.

various clay units (Qc and QTc) mapped by Dibblee (2008) and observed during the field visit for this current study. As such, all of these mapped deposits are at least older than ca. 20,000 BP (i.e., were laid-down well before human occupation in the region). Additionally, the emplacement of the Pisgah lavas effectively blocked deposition of new alluvial material from the Rodman Mountains to the south. This explains both the lack of large late Pleistocene and Holocene alluvial fan deposits– that are present in the northern portion of the Calico Solar project area and throughout the Basin and Range– as well as the presence of so many relict landforms at the surface. Whereas the alluvial fan material in the northern section has its source in the mountain valleys of the Cady Mountains, any more recent depositional landforms within the southern section are comprised of material reworked from the older relict alluvial landforms.

- **Pisgah Lava** (Sensitivity: None to Very Low). As stated above, the Pisgah Lava flows have been dated to approximately 20,000 BP. As such, they have no potential for harboring buried archaeological deposits. The exception to this statement is the eolian sand deposits that have mantled certain limited areas along the base of the lavas. Relatively limited sand sheet has built up along the edge of a portion of the flow near the Pisgah Substation, in the eastern portion of the study area. Limited subsurface exploration indicated that the sheet was only approximately 30 cm thick and directly overlaid the lava flow. Lack of soil development within the sand sheet suggests that it is a very recent, unstabilized deposit. No subsurface archaeological materials were observed.

  Figure 11 shows a desert pavement that has developed on a portion of the Pisgah flow — elevated on a mantle of accretionary eolian sand and silt — and gives an indication of the degree of pavement development that can be expected on a 20,000 year old lavic surface.

  A portion of at least one large archaeological site identified during inventory efforts (KRM-135; URS 2009) is located in close association with the Pisgah Lava flows. The higher elevation western portion of this site is located on fine grain sediments, with a pebbly surface, which appear to be mantled into small embayments of the lava flow. The sediments within these areas appear to be a mixture of fine grain alluvium from a nearby drainage which have been deposited as an older terrace set and preserved within these embayments, along with more recent eolian sands and silts accreted onto the existing surface. As such, these limited portions of KRM-135 appear to have the potential for at least a minor subsurface component, and may represent the only limited potential for buried archaeological deposits associated with the Pisgah Lava flows.

- **Erosional Fan Remnant** (Sensitivity: Very Low). A large proportion of the southern section of the project area is dominated by very old alluvial landforms referred to here as "erosional fan remnants." The erosional fan remnants are generally coincident with the areas of Quaternary fanglomerate (Qof) as mapped by Dibblee (2008). The fanglomerate is an early Pleistocene or older alluvial/fluvial deposit up to 300 feet thick, comprised of poorly sorted coarse gravels and cobbles of mixed Mesozoic porphyry complex, metavolcanics, and Tertiary volcanic rocks (as well as chalcedony/jasper). The clast-supported matrix appears to be comprised of loamy sand with a high $CaCO_3$ content. This very old Quaternary geologic unit has been uplifted along the multiple faults that run north–south through the southern portion of the project area. These faults may have a normal and rotational component, with the highest portions of the uplifted erosional fan remnants located along the fault scarp, which have eroded steeply toward the east (along the scarp) and more gradually to the west.

As the name implies, these uplifted relict landforms are largely erosional, particularly along the steeper side slopes of the fan remnants. The flatter summits of the fan remnants (or “ballenas” if the ridges have been completely separated from other portions of the original alluvial unit) are more stabilized and may exhibit more well-developed desert pavements than the side slopes. This pavement likely formed through a combination of accretionary processes (McFadden, Wells, and Jercinovich 1987) as well as erosional process, where the finer alluvial matrix is eroded away leaving a disproportionate amount of larger clasts at the surface (McAuliffe and McDonald 1995). Subsurface profiles along the side slopes exhibit Stage III to IV $CaCO_3$ morphology, consistent with a Pleistocene or older age.

An additional small area of erosional fan remnant, not mapped as Qof by Dibblee (2008), was identified near the Pisgah Substation, in the western portion of the project area. The subsurface profile, exposed in a channel that cuts through the deposit indicates that it is similar to the Qof — with similar lithology and $CaCO_3$ development — and may be functionally related. The uplifted exposed summit of the fan remnant is limited to a small area east of the Pisgah Substation, while an older depositional fan apron that appears to be related to the fan remnant extends out to the west.

In general, the areas mapped as erosional fan remnant (and Qof by Dibblee 2008) have a very low potential for harboring buried archaeological deposits. These landforms are far too old to bury archaeologically sensitive paleosols. The large number of prehistoric archaeological sites present on the surface of these landforms speaks to both their antiquity and the presence of valuable lithic materials (volcanics and silica rich precipitates) within the fanglomerate deposits.

An exception to this, as on other landforms discussed in this study, is the presence of small confined areas of fine-grain recent eolian deposition. Within the erosional fan remnants, these areas are generally limited to small coppice dunes (small piles of sand built up around and temporarily stabilized by vegetation). The coppice dunes observed in the project area are generally very small, averaging less than 0.5 meter tall by 1 meter wide. Due to their limited area, it is very unlikely that they would obscure an entire site, or bury artifacts significantly different than those observed on the site as a whole.

- **Inset Fans** (Sensitivity: Very Low to Low). Numerous distinct inset fans were mapped within the southern portion of the Calico Solar project area. These are very gross landform designations and, in reality, the areas mapped as inset fan may be comprised of numerous component landforms. However, the dominant landforms in these areas consist of depositional alluvium (fans) inset between older relict landforms.

  Perhaps the most geomorphically complicated and interesting of these inset fan units is IF1, located in the central-western area of the southern section of the Calico Solar project area. This area has a gravel and cobble surface lag deposit that forms a well-developed desert pavement, and appears somewhat similar to the clasts from the surrounding Qof fan remnants. The source material for these clasts is likely largely from the eroded fan remnants. However, an examination of the subsurface matrix indicates a much different geomorphic origin for this area. IF1 is underlain by a reddish brown lean clay, which exhibits a course angular blocky structure. Ped faces, when freshly excavated and exposed, exhibit a distinct glossy clay film that may be slickensides, related to periodic wetting and drying cycles. Geotechnical borings B006, B007, and B008 indicate that this clay is over 50 feet thick.

In lower lying areas (including the relict alluvial flat; see below), the clay is overlain by a shallow, well-developed soil profile with a well-developed desert pavement that represents a secondary inset fan. These soils exhibit Stage II to III $CaCO_3$ formation, with diffuse carbonate throughout the profile and distinct thick and indurated laminae within the Bk- and/or K-horizons. Where observed, subsurface profiles contain a well-developed Av-Bwk-Bk-Btk-BCk pedogenic sequence. These pedogenic features suggest that the soil within the IF1 area (and relict alluvial flat), as well as the clay they overlie, are very old, and are consistent with Pleistocene and early Holocene soils observed at other locales within the Mojave Desert (see e.g., McDonald, McFadden, and Wells 2003:Table 1). The contact between the surface soil unit and the clay appears to be an erosional unconformity.

In higher relief portions of IF1, it appears that these soils have either been stripped away or never formed, leaving distinct inset fan remnants and ballenas composed entirely of the clay with a coarse gravel and cobble deflated lag deposit at the surface. Indeed, the IF1 structure is old enough that it too has been dissected and contains both erosional and depositional landforms. An additional indication of the age of the clay unit is the presence of distinct, approximately 5cm thick veins and inclusions of gypsum precipitate within the clay. Given its age and physical characteristics, the underlying thick clay unit at IF1 may be functionally related to the late Miocene or early Pleistocene claystones (QTc) mapped by Dibblee (2008) south of the Calico Solar project area. These are described as light reddish-brown lacustrine deposits that are soft to moderately hard (Dibblee 2008) and which are likely the result of a large paleo-lake that once occupied the area.

Given the age of the soils, the lack of identified paleosols, the very old unconformable lower clay unit, and the largely erosional nature of the relict IF1 inset fan, the potential for buried archaeological deposits is considered extremely low.

The other inset fan units (IF2 and IF3), mapped to the east of IF1 are more typical of inset fans in desert piedmont contexts, in that they do not appear to be underlain by, or composed of, the very old resistant clay unit. These inset fans are, instead, largely composed of reworked and redeposited alluvium from the side slopes of the fan remnants into which they are inset. Subsurface pedogenic indicators observed during the field reconnaissance and in geotechnical borings indicate that these other inset fans are relatively old (middle Holocene?). Subsurface profiles observed within inset fans IF2 and IF3 generally correspond to an Av-ABw-Btk-Bk Cox-C sequence with Stage I+ to II $CaCO_3$ morphology. While these soils are likely younger than those observed in other areas across the southern section of the study area, no paleosols were discovered.

In general, these inset fans are considered unlikely to contain buried archaeological sites because they were largely laid down unconformably on the erosional Pleistocene fanglomerate deposits. The preservation of archaeological material is wholly dependent on the erosional history prior to deposition of the inset pediment.

Given the highly erosive nature of the fanglomerate piedmont in general, this type of localized subsurface preservation seems unlikely.

The final smaller inset fan (IF4) mapped at the western extent of the Calico Solar project area, inset between the relict alluvial flat and the Pisgah Lava appears much younger and more active than the other inset fans. The meandering channel that created the inset fan has been heavily affected by modern disturbance adjacent to it, and the construction of a culvert under Highway 40 which focuses numerous small upstream gullies into a single drainage. Profiles within a stabilized bank of the incising channel show that it has actively eroded the underlying paleosol (probably related to the relict alluvial flat) and redeposited it unconformably further downstream. The nature of the relatively high-energy unsorted gravelly alluvium upstream suggests that any artifacts on this surface may be the result of erosion and redeposition. As such, the IF4 inset fan is also considered to have very low potential for buried archaeological deposits (with no surface manifestation); though additional reworked artifacts, where they are evident on the surface, may be partially buried in a highly disturbed context within recent depositional units.

- **Relict Alluvial Flat** (Sensitivity: Very Low). The large area mapped as "relict alluvial flat," in the western portion of the project area, appears to be functionally related to the IF1 inset fan. As such, this area could also be considered an apron of the IF1 inset fan. However, alluvial flat is preferred here because it describes the properties of the geomorphic surface — a nearly level alluvial surface between the piedmont and axial stream of a semi-bolson — without assuming genesis from a single parent landform, and without inherent morphological assumptions.[3] As with other landforms, the term "relict" implies that the surface has been stable for a considerable time and, as such, has also been highly dissected.

  This landform can be distinguished from other relict landforms in the southern area by a nearly flat, low lying surface that is cut by numerous braided and anastomatizing channels/gullies. These channels are dominantly oriented in the same direction as the major axial channel (i.e. east–west) that crosses the project area. Between these small channels/gullies tend to be bars of intact desert pavement. Although no borings or test pits were advanced within the western portion of the relict alluvial flat, the geoarchaeological reconnaissance and an earlier geologic reconnaissance of the project area (URS 2008) – which mapped a surface clay unit at the western extent of the project area– suggest that the landform is underlain by the thick Pleistocene/ Miocene clay. Soils in this area have well-developed subsurface horizons that are similar to those observed within the IF1 inset fan (see previous discussion).

  The geomorphic evolution and interpretation of geoarchaeological sensitivity for the relict alluvial flat is considered similar to that of the IF1 inset fan. Given the well-formed pavement, upper pedogenic unit, and dissected nature of the relict flat, it appears that this area was dominated by a stable and subsequent erosional geomorphic regime for much of the Holocene. The potential for buried archaeological deposits within this area is considered very low.

[3] For example, a fan apron is generally assumed to consist of a thin mantle of relatively young alluvium that typically buries an older pedogenic soil (Peterson 1981:51).

- **Axial Channel** (Sensitivity: Very Low to Moderate). The "axial channel" represents the area occupied by the main drainage that bisects the Calico Solar semi-bolson, as well as component landforms related to the active channel. While the active channel is primarily an erosional structure, small depositional features such as alluvial flats, limited terraces, and fine overbank deposits are the result of deposition by the axial channel. In the absence of identified springs or fresh water sinks/lakes, the axial channel represents the largest and most reliable source of seasonal water within the Calico Solar project area. As such, this would have represented a very important resource to prehistoric populations in the project area. The only limited evidence for food processing (milling equipment) found during the cultural resources survey of Calico Solar is found in close proximity to this watercourse.

  Excavations were performed at TP050, near the interface of the lower fan piedmont apron and the axial channel zone. It is difficult to determine if the fine-grain alluvium at the surface of this location originates from the on-fan drainages or the axial channel, but appears that it may be related to an overbank deposit of the channel. The subsurface profile within TP050 is well-developed but unusual. The lack of pavement development at the surface is not consistent with the subsurface profile. An Av horizon has developed in the upper 3 to 5 cm, with a slightly consolidated loamy sand with gravel subsoil (ABw). This is followed by a zone of weak clay and carbonate accumulation (Btk) with observable rubification (ox). This overlies a second Btk-horizon with much stronger structure, distinct clay films on grains within peds, and carbonate accumulation completely surrounding larger gravels and cobbles (Stage II). This is underlain by an indurated carbonate layer (Bkm; Stage III+), as well as a Bk and Cox horizon not shown in Figure 18b.

  The existence of multiple B-horizons and gradual increase of carbonates to an indurated lamina is common in very old soils. However, the low carbonate accumulation and weak structure in the upper horizons (with such a well-developed lower profile) is unusual. A distinct lithologic contact is observable between the two Btk horizons with the upper dominated by fine-grain loamy sand and the lower dominated by coarse gravels and cobbles. While this may simply represent a facies shift during a single depositional event, the above observations suggest that the contact may also be pedogenic, with the lower Btk representing a truncated portion of a buried soil. In either case, the potential for intact buried archaeological deposits is low (i.e., either a buried surface is absent, or any archaeological deposits on that surface have likely been removed through subsequent erosion).

  Test Pit 051 was placed in a similar geomorphic setting near the interface of the toe of a fan apron and the axial channel zone. The upper pedogenic unit is less well-developed than the preceding example, with an AB-Bw-Bwk-C profile, corresponding to a late Holocene age. This unit overlies a very old buried pedogenic unit with a Btk-Bkm-Km1-Km2-Bk-Ck-C profile. Again, a truncated erosional contact seems to be indicated.

  No well preserved upper horizons of paleosols were observed in the subsurface explorations within the vicinity of the axial channel. However, multiple truncated paleosols were noted below relatively young fine-grain alluvial deposits. This suggests that there is the potential for low-energy burial of older land surfaces under significant amounts of recent alluvium (up to 2 meters) within the reach of the axial channel. The preservation of archeological deposits on these surfaces is entirely dependent on the erosional history prior to burial (in both of the test pits discussed here, it appears that significant erosion may have occurred prior to burial). Given these considerations, the geoarchaeological sensitivity of the axial channel is considered low within the current active channel/wash, but moderate on the small terraces and minor component landforms adjacent to the channel where, given the right geomorphic history, significant fine-grain low-energy alluvium *may* bury intact relict surfaces. The archaeological sensitivity of these limited areas is bolstered by the proximity to the only major seasonal watercourse identified within the study area.

Conclusions

The findings from this geoarchaeological study of the Calico Solar project area are consistent with previous findings from the Mojave Desert. In a recent summary of the region, Sutton (1996) concludes that, contrary to the popular belief that all archaeological sites in the Mojave Desert exist in surface contexts, "there are… many depositional environments [within the Mojave], and there is a great potential for buried sites in many areas… e.g., along the Mojave River, along lakeshores, and in cave sites" (1996:225). Given results from other areas (e.g., Roberts, Warren, and Eskenazi 2007), dune complexes, springs, and other areas with widespread episodic and stabilized eolian deposition, should also be added to the list. All of these landform types are largely absent from the Calico Solar Project study area, consistent with an overall low sensitivity for buried archaeological sites within the landforms of the project area.

The axial channel (and associated deposits), which cuts across the central portion of the study area and interfaces with fine-grain sediments from the toe of the alluvial fan piedmont, may represent the only geomorphic feature in the Calico Solar project area where buried archaeological deposits (with no surface manifestation) may reasonably be expected. While much smaller than the Mojave River drainage discussed by Sutton (1996), the same geomorphic processes that have buried sites along the Mojave River may be at play here, though on a much smaller scale. The fine-grain alluvial deposition along the margins of the axial channel — in the form of limited terrace deposits and alluvial flats — is functionally similar to that along the Mojave River, though large stratified alluvial terraces like those associated with the larger river, are clearly absent. As such, buried archaeological deposits, if present in this portion of the project area, will likely be aerially confined sites with a sparse deposit similar to surface sites in the Calico Solar study area, buried under up to 2 meters of very recent fine-grain alluvium. Given the likelihood that the course of the axial channel has meandered over its history, and scoured any existing land surfaces, the preservation of buried archaeological sites in this area will likely be greatly limited.

The vast majority of the northern alluvial fan piedmont is represented by a subsurface depositional environment that is too high-energy and coarse, with no observed paleosols, to preserve buried archaeological deposits. This lack of depositional sensitivity is coupled with an absence of economically viable lithic resources, which may largely explain the absence of surface sites on the fan piedmont. The high-energy erosional contacts between buried paleo-surfaces and overlying mantle deposits within the fan aprons, coupled with the lack of viable economic resources, largely precludes the presence of buried archaeological deposits within in this portion of the project area as well. Both the very old age and largely erosional nature of the major landforms in the southern section of the project area indicate that buried archaeological sites (with no surface manifestation) are very unlikely. It appears that the greatest potential for site burial in the southern portion of the Calico Solar Project area is in those places where unconsolidated and active eolian sands have obscured alluvial landforms. However, these eolian features appear to be so limited that they are unlikely to obscure any significant portion of an archaeological site.

A secondary conclusion of this geoarchaeological study is that prehistoric site location within the Calico Solar Project study area seems to be largely dictated by the availability of raw lithic materials. The series of coalescing fans that make up the alluvial fan piedmont north of the railroad tracks have their source in the Cady Mountains. An examination of Dibblee's (2008) geologic map of the Cady Mountains, indicates that the dominant material present above these fans is granite to quartz monzonite (gqm), with more limited (and presumable more resistant) outcrops of basalt and andesite (Tb and Ta). This is confirmed by subsurface geoarchaeological investigations of the alluvial fans, which show that the majority of material present is coarse-grained granitic sands, gravels, and cobbles, with little utility for prehistoric tool making. On the other hand, the fanglomerate remnant alluvial fans — and inset alluvial fans, which generally are comprised of reworked fanglomerates — that make up the majority of the landforms south of the railroad tracks, have a much more variable parent material — including volcanics, metavolcanics, and silicates (jasper, etc.) — more conducive to prehistoric tool production.

Except for minimal editorial contributions, the following subsection was adapted from Solar One ***Data Response 94*** by Jay Rehor, M.A., RPA

Staff's assertion that "the degree of desert pavement [development] is *not* in fact indicative of the presence of buried archaeological deposits" is an accurate statement (CEC 2009: 4; *emphasis* added). However, clarification is needed within both Staff's statement, and the initial theoretical model that was being reacted to (URS 2009:4-2). A well-formed desert pavement does not preclude the existence of a *buried component* to a site located on that pavement, but it does significantly decrease the likelihood that a buried archaeological deposit *not already evident on the surface* is buried below it. See Data Response 93 for a discussion of buried archaeological sites with no surface manifestation.

The vast majority of prehistoric archaeological sites recorded within the Calico Solar Project Area are situated on well-developed desert pavements located in the southern portion of the Project Area. The age of an archaeological deposit, in relationship to a given pavement, has relevance in terms of the potential for buried site components. Given the currently accepted accretionary model of desert pavement formation (see Data Response 93), if (relatively younger) artifacts are deposited on an already well-developed and stabilized pavement, few, if any, of the artifacts will work their way down in the stratigraphic column. Alternatively, if (relatively older) artifacts are deposited on an actively accreting and, as yet, unformed or stabilized surface, over time a portion of these artifacts will become incorporated as part of the desert pavement, while a portion will remain throughout the depositional column. For example, it has been shown that Paleo-Indian sites, located on desert pavement in arid to semi-arid environments, can possess artifacts from the surface of the pavement up to 70 cm deep (Apple and York

1993; Davis 1970). Although it is unlikely that accreted sediments accumulated this thick, additional subsurface pedoturbation (e.g., argillic shrink/swell, displacement by plant roots) may explain the significant depth of these very old artifacts below the surface.

The lack of time-sensitive diagnostic artifacts across the Calico Solar project area makes it difficult to assess what sites are older, and thus more likely to contain buried artifacts, versus those that are younger and less likely to contain buried components. One corollary, which may prove useful, is the degree of weathering of surface artifacts. The longer that artifacts have been part of the desert pavement, the more patination and visible weathering from eolian abrasion on the surface of the artifact. As such, this theory would contend that sites with a large number of heavily weathered surface artifacts will have a higher number of subsurface artifacts than a site with relatively "fresh" looking artifacts. Testing of this concept may prove beneficial during any Phase II investigations at Calico Solar. Additionally, while the accretionary model of pavement formation likely explains the majority of pavements observed across the Calico Solar project area, some pavements/stony surfaces likely formed through erosion and are unlikely to contain buried site components (see e.g., the Data Response 93 discussion of relict fan remnants within IF1).

While it is true that artifacts *may* be present below a surface archaeological site on desert pavement, it has been consistently demonstrated that in such contexts artifact density decreases significantly and rapidly with depth (typically confined to the upper few centimeters), and that buried artifacts are similar in type to those on the surface with no discernable temporal stratification (e.g., Basgall 2000, 2003; Davis 1979; Hunt 1960; Wallace 1962). As such, it is unlikely that any functional interpretation will be altered by the recovery of the limited artifacts incorporated in the subsurface matrix of a site on desert pavement. The discussion of artifacts buried beneath desert pavement surfaces may be moot, at least for the majority of the sparse lithic sites at Calico Solar, which lack any diagnostic artifacts (i.e., no new functional or temporal information is likely to be gained from any limited subsurface recovery).

The peer-reviewed sources that Staff references in Data Request 94 (Harvey and Wells 2003; McDonald, McFadden, and Wells 2003; Wells, McFadden, and Dohrenwend 1987) do not deal specifically with the relationship between desert pavement development and the burial and preservation of the archaeological record. Instead, these studies deal with the timing of major depositional events and, peripherally, with accretionary desert pavement formation processes on these landforms (see the proceeding response for a discussion of this literature and topics). In fact, these studies, in the limited nature in which they address desert pavements, do actually *support* the contention that more well-developed pavements are less likely to contain buried archaeology (not already evident on the surface). Within these studies, moderate to strongly developed desert pavements are consistently shown to be associated with early Pleistocene to early Holocene landforms (see e.g., McDonald, McFadden, and Wells 2003: Table 1; Harvey and Wells 2003: Table 2). As such, well-developed desert pavements are generally too old to bury archaeological deposits, and *are* indicative of the absence of archaeological deposits not at least partially evident on the surface. However, an even better measure of landform age– and associated buried archaeological potential– includes a combined analysis of soil development, parent material, and pavement development, as discussed in the previous Data Response 93.

Perhaps more directly relevant to staff's concerns, regarding the potential for buried components of surface archaeological sites in desert pavement contexts, is a recent publication by Ahlstrom and Roberts (2001) which reports on findings from the Sonoran Desert in southern Arizona. Based on excavations at eight archaeological sites with significant amounts of stabilized desert pavement, the authors report finding a total of 23 buried thermal features, four "occupation surfaces", one pit structure, and one refuse deposit. The authors claim that their results "call into question the idea that low-density, low-diversity artifact scatters associated with desert-pavement surfaces can simply be dismissed as surface manifestations with no potential for subsurface cultural remains" (Ahlstrom and Roberts 2001:2).

Despite Ahlstrom and Robert's (2001) claims, a close reading of their study suggests that the subsurface features identified in their investigations seem to be confined to very specific contexts: fine-grain alluvial and/or eolian depositional environments, within or directly adjacent to cleared circle features in the desert pavement, and sites with a relatively diverse artifact assemblage. Indeed, all of the sites discussed in the paper contain a high artifact diversity (at least compared to the sites recorded at Calico Solar), including lithics, ceramics, ground-stone/milling tools, rock rings, and cleared circles. Although numerous hearth features were found buried below a pebble surface, the authors contention that they were buried below desert pavement is not borne out by the evidence. In fact, hearth features that were buried below "desert pavement" were directly adjacent to the edge of a cleared circle. As such, the pebbles and stones covering the surface above the hearth features were not part of an intact desert pavement, formed over thousands of years, but smaller clasts which had begun to creep into and "heal" the surface disturbance of the cleared circle feature.

Unfortunately — and by the authors' own admission (Ahlstrom and Roberts 2001:2) — data on the quality and quantity of desert varnish or rubification was not collected prior to destruction of the ground surface. However, there was presumably an observable difference in the true desert pavement surrounding the cleared circles, and the stones which had begun to infill from the outer edge toward the center and covered the buried features (e.g., further distance between surface clasts; lower degree of varnish and rubification than surrounding clasts from undisturbed pavement; rubification on the dorsal surface of stones which had originally developed in-place and then were redeposited "upside-down"; etc.). None the less, Ahlstrom and Roberts' results are instructive to archaeologists working in arid environments with desert pavement. If testing features cleared in the desert pavement ("cleared circles"), archaeologists should be aware of differences in the quality of the stone surface at the edge of the clearings, and place units accordingly at the edge of the true cleared area.

Based on years of experience and accumulated data, Carrico and Quillen (1982:184), concluded that "excavations of rock circles and cleared circles have consistently proven unproductive in southern California and western Arizona desert regions." Indeed, Ahlstrom and Robert acknowledge that their "research contradicts the experience of archaeologists who have excavated rock rings and cleared circles, or who have dug units through desert pavement without result" (2001:19). As such, their findings must be taken in the larger context and by no means guarantee that subsurface features will be present in association with cleared circles. Rather, their results suggests that limited testing of such features should continue, in certain contexts, and that cleared circles on desert pavements shouldn't be written-off completely — despite a preponderance of evidence to the contrary.

C.3.4.10 CLASS III INTENSIVE FIELD SURVEY

Archaeological Field Survey Methodology

Survey of the Calico Solar Project APE was conducted between August 4 and October 31, 2008. Key cultural resources personnel who conducted and/or supervised the field survey and prepared the technical report are Brian K. Glenn, MA, RPA (URS Cultural Resources Group Leader and Editor), Rachael Nixon, MA, RPA [URS Principal Investigator (PI)], Sarah Mattiussi (URS Staff Archaeologist), and Kirsten Erickson, MA (URS Architectural Historian). Field crews and field-office personnel were directly supervised by URS PI Rachael Nixon and URS Staff Archaeologists Dustin R. Kay and Sarah Mattiussi. The pedestrian survey for the Class III Intensive Field Survey covered the Calico Solar (phase 1 and 2) APE as well as an additional 200 feet beyond the APE. The principal survey method consisted of a systematic walk-over in parallel transect intervals no greater than 15 meters. Areas of steep terrain (greater than 45° angle) where access was not feasible due to unsafe/unstable surfaces were not surveyed. These areas total less than 11 acres and occur within the northeastern Project APE along the south-southwest facing slope of the Cady Mountains. The areas of steep terrain not surveyed have an extremely low likelihood of containing cultural resources based on the angle and decomposition of volcanic rocks eroding downslope. Areas that were situated within or atop steep terrain with the potential for cultural resources were investigated (*e.g.,* caves and ridge tops). The survey transects extended across the entire horizontal extent of the archaeological Project APE. Survey crews were guided by Trimble XH sub-meter global positioning system (GPS) units uploaded with records search, township, built-environment features, and project-specific boundary data. Individual crews were assigned portions of sections for survey. Garmin Model 150 GPS units were carried as backups and as communication devices.

The guidelines applied to field survey and recordation of cultural resources within the Calico Solar Project APE was provided by BLM archaeologist Jim Shearer. The guidelines provided that archaeological sites consisted of 5 or more historic period artifacts or prehistoric period artifacts with a tool (6 or more artifacts) within 30 meters of each other. Groups of 5 or fewer prehistoric artifacts (without a tool) within 30 meters of each other were recorded as isolated finds. Individual and groups of less than 5 historic period artifacts were not recorded.

Site containing higher concentrations of artifacts over a large area were assigned individual Locus numbers. Loci were assigned for areas within sites with higher artifact concentrations. A locus was assigned to concentrations of more than 6 artifacts within a discrete location. Discrete locations were defined as single reduction loci, multiple single reduction loci, and/or lithic scatter concentrations. In the case of multi-component sites, historic and prehistoric components were assigned an individual locus when possible.

From previous investigations on similar terrain, it was inferred that archaeological sites would be found on areas of desert pavement. For the purpose of this investigation desert pavement was defined as a desert surface that is covered with closely packed, interlocking angular or rounded rock fragments of pebble and cobble size. Within the Calico Solar Project APE, and other areas of the desert, a portion of the cobble constituents of desert pavement are of cryptocrystalline silicate (chalcedony, jasper, others) materials used by Native Americans for the production of flaked stone tools. As such, the correlation of these surfaces with the archaeological materials contained therein may be informative. In addition, the pavement stabilization level is directly correlated with the likelihood of the matrix containing buried deposits, *i.e.,* the more visible sediments the more likely the presence of buried archaeological deposits. The following is an elementary subdivision of desert pavements used to classify variability in surfaces.

- <u>Partially stabilized</u> pavement has 30% or greater of sediments visible.
- <u>Moderately stabilized</u> pavement has 10% to 30% of sediments visible.
- <u>Stabilized pavement</u> has pavement 0% to 10% of sediments visible.

The California Archaeological Resource Identification and Data Acquisition Program: Sparse Lithic Scatters (CARIDAP) was applied in the preliminary field surface identification and management recommendation with regards to lithic scatters identified within the Project APE (Jackson et al., 1988). No subsurface testing, data recovery, or surface collections of artifacts occurred during the Class III Intensive Field Survey. The CARIDAP criteria for classification as a sparse lithic scatter are as follows:

1. Contains only flaked-stone and lack other classes of archaeological materials (e.g., groundstone, fire affected rock, bone, or shellfish remains, pottery);
2. Appears to lack a substantial subsurface deposit (based on surface observations only); and
3. Exhibit surface densities equal to or less than three flaked-stone items per square meter.

These guidelines were applied throughout the entire Class III Intensive Field Survey for the Calico Solar Project APE.

<u>Site Recording Methodology</u>

Once identified in the field, survey teams recorded archaeological sites and isolates by completing the appropriate Department of Parks and Recreation (DPR) 523 Series forms. Form information was collected using a combination of staff observations and data recording devices including sub-meter GPS and digital cameras. Each isolated find and sites were given a designation that included the initials of the team leader and a sequential number, e.g., RAN-001 with isolated finds including the designator “ISO,” e.g., RAN-ISO-002. Site and loci boundaries were delineated by team members transecting the area of the find with transects spaced no greater than 5 meters apart. Artifacts and/or artifact clusters were flagged, described, and photographed. Individual artifacts not part of a larger concentration were point-provenienced with the GPS, as were concentration smaller than 5 meters across. Concentrations with a diameter of 5 meters or more were recorded as polygons representing the outer loci boundary. Digital photographs were taken of selected artifacts and concentrations. Each site was recorded with one or more photographs. All photographs were recorded onto the team's log with relevant data including temporary site/isolated designation, date, direction, recorder, and subject. Trails segments also mapped with the sub-meter GPS, following the trail until terminated or no longer feasible to follow, measured, described in notes, and photographed.

Data Processing

Data collected in the field was transferred to electronic field office data files on a daily basis. Data were quality checked to ensure conformance with the scope of work, agency satisfaction, and regulatory compliance. GPS data were downloaded using TerraSync software and transmitted to GIS staff for post-processing, e.g., applying differential data correction. Initial plots of data from each survey team were compiled and reviewed to determine the validity of resource boundaries with regard to established methods. Where appropriate, resource areas were combined into larger units based on distance between artifacts and/or concentrations, i.e., less than 30 meters. GIS data were organized to allow for submission to BLM according to recently adopted protocols.

Built-Environment Field Survey Methodology

On August 19 and October 27 and 28, 2008, an intensive historic architecture survey was conducted to account for the properties that appeared to be older than 45 years (1963 or earlier) within the historic architecture APE, which included the Project APE and a half-mile radius. Following completion of the survey, URS Architectural Historian Kirsten Erickson recorded the properties that appeared to be older than 45 years through the appropriate DPR 523 series forms (Confidential Appendix D, Newly Recorded and Updated Built-Environment Resources), and evaluated the properties for eligibility per the criterion of the NRHP and/or CRHR. Properties less than 45 years old were noted, but not formally recorded or evaluated.

As part of the historic architecture survey, Ms. Erickson contacted San Bernardino County Land Use Services, City of Barstow Community Development department, and Mojave River Valley Museum on September 15, 2008 to identify cultural resources within a 1-mile radius around the Project footprint listed pursuant to ordinance or recognized by a local historical society or museum. To date, no responses have been received from the local agencies and historical society.

In addition to these efforts, site-specific and general primary and secondary research was conducted at the University of California at Riverside, Rivera and Science libraries; the San Bernardino Archaeological Information Center at the San Bernardino County Museum; San Bernardino County Recorder's office; San Bernardino County Assessor's office; and numerous online resources. Thomas Taylor, Manager of Biological and Archaeological Services for Southern California Edison, provided site-specific information about the Pisgah Substation and the 12-kilovolt and 220-kilovolt transmission lines within the Project Area.

Historic maps were obtained from the University of California at Riverside science library and the Archaeological Information Center at the San Bernardino County Museum in Redlands. Maps obtained include 1955 15-minute U.S. Geological Survey quadrangles, five maps depicting the Old National Trails Highway, Punnett Brothers Map of San Bernardino County (1914), Kremmerer's map of San Bernardino County (1925), and Thomas Brothers Settlers and Miner's Map of San Bernardino County (1932). These maps were reviewed to identify possible unrecorded historical structures and archaeological sites within the APE and 1-mile search radius.

Results of Cultural Resource Field Inventory

Results of Pedestrian Archaeological Survey of the Project APE. Overall surface visibility was good to excellent across the Calico Solar Project APE. Visibility ranged from 90% to 100%, and averaged approximately 80% of the ground surface; areas with greater visibility were thoroughly inspected for cultural materials to ensure adequate coverage for resource discovery. Evidence of disturbances within and surrounding the APE include numerous rodent burrows, flash flooding, mining activities, livestock trampling, OHV use, and access roads.

The relocation of previously recorded resources in the APE has presented a challenge, as most of the previously recorded resources were documented prior to the invention or widespread use of Global Positioning System (GPS) technology. The ability to accurately place the locations of small sites on a 1:24,000-scale USGS topographic map in a flat expansive environment such as the project area without the aid of GPS technology is imperfect at best, and the accuracy of the location information for these previously recorded resources is questionable. The lack of detailed site descriptions and absence of site sketch maps in many of the older site forms further hampered the site relocation effort. Due to the factors described above, only fourteen of the 49 previously recorded sites in the APE were re-located, including the following; CA-10649H, CA-SBR-1896, CA-SBR-1908, CA-SBR-2910H, CA-SBR-4558H, CA-SBR-4681, CA-SBR-5600, CA-SBR-5796, CA-SBR-6511, CA-SBR-6512, CA-SBR-6513, CA-SBR-6520, CA-SBR-6521, CA-SBR-6528, CA-SBR-6693H. The applicant's consultant, URS, is confident that many more of the previously recorded sites may have been encountered during the current survey effort; however, they could not be matched on an individual basis to the existing DPR forms due to inaccurate locational information and limited site descriptions. The inability to accurately relocate previously recorded cultural resources renders it impossible to correlate old site forms with the new site data obtained by the current field survey effort. Thus, new site record forms with GPS-based site locations are being prepared for all resources identified within the project APE that could not be confidently linked to a previously recorded resource. Updated DPR site forms were prepared only for the fourteen relocated resources listed above.

The URS archaeological team identified a total 401 archaeological resources in the project APE as part of the initial Class III archaeological field survey, including 248 isolates and 139 archaeological sites (9 of which were updates) within the Calico Solar Project APE. Of the 139 new and updated archaeological sites, 128 are prehistoric, 11 historic, and 4 multi-component. Resources listed and described below in Table 5 are newly identified.

Cultural Resources Table 5
Initial Cultural Resources Inventory for the Project Area of Analysis
(SES 2008c, SES 2008e)
(100% of APE)

Site No.	Site Type	Cultural Context	Potential for Buried Deposits Based on Geomorphologic Information	Project Area Location & Landform
DRK-001 Ca-SBR-12990	Lithic Scatter/Lithic Reduction	Prehistoric	Very Low	North Alluvial fan
DRK-012 CA-SBR-12991	Lithic Scatter/Lithic Reduction	Prehistoric	Moderate	North Alluvial fan
DRK-021H CA-SBR-12992H	Trash Scatter	Historic	Low	North Alluvial fan
DRK-023 CA-SBR-12993	Lithic scatter	Prehistoric	Low	North Alluvial fan
DRK-026 CA-SBR-12994	Lithic scatter	Prehistoric	Low	North Alluvial fan
DRK-045 CA-SBR-12995	Lithic scatter	Prehistoric	Low	North Alluvial fan
DRK-110H CA-SBR-12996H	Trash Scatter	Historic	Low	North Alluvial fan
DRK-111/H CA-SBR-12997/H	Trash Scatter/Lithic Scatter	Prehistoric/ Historic	Very Low	North Alluvial fan
DRK 114 CA-SBR-12998	Lithic scatter	Prehistoric	Low	North Alluvial fan
DRK-115H CA-SBR-12999H	Trash Scatters	Historic	Low	North Alluvial fan
DRK-116 CA-SBR-13000	Lithic Scatter/Lithic Reduction	Prehistoric	Very Low	North Alluvial fan
KRM-002 CA-SBR-13028	Lithic Scatter/Lithic Reduction	Prehistoric	Moderate	North Alluvial fan
KRM-003 CA-SBR-13029	Lithic Scatter	Prehistoric	Low	North Alluvial fan
KRM-008 Ca-SBR-13030	Lithic Scatter/Lithic Reduction	Prehistoric	Low	North Alluvial fan
KRM-024 CA-SBR-13031	Trail	Prehistoric	Very Low	North Alluvial fan
KRM-028 CA-SBR-13032	Trail	Prehistoric	Very Low	North Alluvial fan
RAN-011 CA-SBR-13053	Lithic scatter	Prehistoric	Moderate	North Alluvial fan
RAN-025 CA-SBR-13054	Lithic scatter	Prehistoric	Very Low	North Alluvial fan
SGB-007 CA-SBR-13095	Lithic Scatter/black-on-gray ceramic sherd	Prehistoric	Moderate	North Alluvial fan

Site No.	Site Type	Cultural Context	Potential for Buried Deposits Based on Geomorphologic Information	Project Area Location & Landform
SGB-013 CA-SBR-13096	Lithic scatter	Prehistoric	Low	North Alluvial fan
SGB-017 CA-SBR-13097	Lithic scatter	Prehistoric	Moderate	North Alluvial fan
SGB-041 CA-SBR-13104	Lithic scatter	Prehistoric	Moderate	North Alluvial fan
SGB-097 CA-SBR-13105	Lithic scatter	Prehistoric	Very Low	North Alluvial fan
SGB-099 CA-SBR-13106	Lithic scatter/hearth	Prehistoric	Very Low	North Alluvial fan
SGB-104 CA-SBR-13107	Lithic scatter	Prehistoric	Very Low	North Alluvial fan
SM-027 CA-SBR-13113	Lithic Scatter	Prehistoric	Low	North Alluvial fan
EJK-002 CA-SBR-13123	Lithic Scatter	Prehistoric	Low	South Relict Alluvial fan
CA-SBR-4558H	Logan Mine	Historic	Moderate	North Alluvial fan
CA-SBR-6512/CA-SBR-6513 (SGB-028)	Lithic Scatter/Lithic Reduction/Stone Mounds	Prehistoric	Low	South Inset fan
DRK-112H P36-014519H	Cairn	Historic	Very Low	North Alluvial fan
DRK 113H P-36-014520	Cairn	Historic	Very Low	North Alluvial fan
RAN-035H P-36-014578	Cairn	Historic	Very Low	North Alluvial fan
DRK-133 CA-SBR-13001	Lithic scatter	Prehistoric	Low	South
DRK-134/H CA-SBR-13002/H	Lithic scatter/historic trash scatter	Prehistoric/ Historic	Moderate	South Alluvial fan
DRK-136 CA-SBR-13003	Lithic Scatter	Prehistoric	Low	South Alluvial fan
DRK-139 CA-SBR-13004	Lithic Scatter	Prehistoric	Moderate	South Inset fan
DRK-140 CA-SBR-13005	Lithic Scatter	Prehistoric	Moderate	South Inset fan
DRK-141 CA-SBR-13006	Lithic Scatter/ Lithic Reduction	Prehistoric	Low	South Inset fan
DRK-142 CA-SBR-13007	Lithic Scatter Lithic Reduction	Prehistoric	Low	South Inset fan
DRK-145 CA-SBR-13008	Lithic Scatter/ Lithic reduction	Prehistoric	Very Low	South Inset fan

Site No.	Site Type	Cultural Context	Potential for Buried Deposits Based on Geomorphologic Information	Project Area Location & Landform
DRK-150 CA-SBR-13009	Lithic Scatter	Prehistoric	Moderate	South Inset fan
DRK-152 CA-SBR-13010	Lithic Scatter	Prehistoric	Moderate	South Inset fan
DRK-153 CA-SBR-13011	Lithic Scatter	Prehistoric	Low	South Inset fan
DRK-155H CA-SBR- 13012H	Trash Scatter	Historic	Moderate	South Alluvial fan
DRK-160 Ca-SBR-13013	Lithic Scatter	Prehistoric	Moderate	South
DRK-163H CA-SBR- 13014H	Trash Scatter	Historic	Moderate	South Alluvial fan
DRK-166 CA-SBR-13015	Lithic Scatter/ Lithic Reduction	Prehistoric	Low	South Pisgah Lava
DRK-167 CA-SBR-13016	Lithic Scatter	Prehistoric	Moderate	South Pisgah Lava
DRK-168H CA-SBR- 13017H	Trash Scatter	Historic	Moderate	South Alluvial Fan
DRK-170 CA-SBR-13018	Lithic Scatter\ Lithic Reduction	Prehistoric	Low	South Pisgah Lava
DRK-171 CA-SBR-13019	Lithic Scatter	Prehistoric	Low	South Pisgah Lava
DRK-173 CA-SBR-13020	Lithic Scatter/ Lithic Reduction	Prehistoric	Low	South Pisgah Lava
DRK-174 CA-SBR-13021	Lithic Scatter/ Lithic Reduction	Prehistoric	Low	South Pisgah Lava
DRK-175 CA-SBR-13022	Lithic Scatter	Prehistoric	Low	South Pisgah Lava
DRK-176/H CA-SBR- 13023/H	Lithic Scatter Trash Scatter	Prehistoric Historic	Moderate	South Axial Channel
DRK-177 CA-SBR-13024	Lithic Scatter	Prehistoric	Low	South Pisgah Lava
DRK-178 CA-SBR-13025	Lithic Scatter/Lithic Reduction	Prehistoric	Low	South
DRK-182 CA-SBR-13026	Lithic Scatter/Lithic Reduction	Prehistoric	Low	South
DRK-184 CA-SBR-13027	Lithic Scatter/Lithic Reduction	Prehistoric	Low	South
KRM-160 CA-SBR-13038	Lithic Scatter/Lithic Reduction	Prehistoric	Low	South
KRM-164 CA-SBR-13039	Lithic Scatter	Prehistoric	Moderate	South Inset fan

Site No.	Site Type	Cultural Context	Potential for Buried Deposits Based on Geomorphologic Information	Project Area Location & Landform
KRM-167 CA-SBR-13040	Lithic Scatter/Lithic Reduction/Rock Feature	Prehistoric	Moderate	South
KRM-170 CA-SBR-13041	Lithic Scatter/Lithic Reduction/Rock Feature	Prehistoric	Moderate	South Inset fan
LTL-008 CA-SBR-13042	Lithic Scatter	Prehistoric	Moderate	South Pisgah Lava
LTL-009 CA-SBR-13043	Lithic Scatter/Lithic Reduction	Prehistoric	Low	South Pisgah Lava
LTL-011 CA-SBR-13044	Lithic Scatter	Prehistoric	Low	South Inset fan
LTL-012 CA-SBR-13045	Lithic Scatter	Prehistoric	Low To Moderate	South Inset fan
LTL-015 CA-SBR-13046	Lithic Scatter/Lithic Reduction	Prehistoric	Low To Moderate	South Pisgah Lava
LTL-016 CA-SBR-13047	Lithic Scatter/Lithic Reduction	Prehistoric	Low To Moderate	South Pisgah Lava
LTL-017 CA-SBR-13048	Lithic Scatter	Prehistoric	Moderate	South Pisgah Lava
LTL-018 CA-SBR-13049	Lithic Scatter/Lithic Reduction	Prehistoric	Low	South Pisgah Lava
LTL-019 CA-SBR-13050	Lithic Scatter	Prehistoric	Low	South Pisgah Lava
LTL-022 CA-SBR-13051	Lithic Scatter	Prehistoric	Low	South Pisgah Lava
LTL-023 CA-SBR-13052	Lithic Scatter	Prehistoric	Moderate	South Pisgah Lava
RAN-101 CA-SBR-13055	Lithic Scatter/Lithic Reduction	Prehistoric	Very Low	South Inset fan
RAN-108 CA-SBR-13056	Lithic Scatter	Prehistoric	Very Low	South Inset Fan
RAN-107 CA-SBR-13057	Lithic Scatter	Prehistoric	Moderate	South Inset fan
RAN-110 CA-SBR-13058	Lithic Scatter	Prehistoric	Low	South Inset fan
RAN-114 CA-SBR-13059	Lithic Scatter/Lithic Reduction	Prehistoric	Low	South Pisgah Lava
RAN-116 CA-SBR-13060	Lithic Scatter/Lithic Reduction	Prehistoric	Low	South Pisgah Lava
RAN-118 CA-SBR-13061	Lithic Scatter/Lithic Reduction	Prehistoric	Low	South Pisgah Lava
RAN-120 CA-SBR-13062	Lithic Scatter/Lithic Reduction	Prehistoric	Low	South Pisgah Lava
RAN-123 CA-SBR-13063	Lithic Scatter	Prehistoric	Low	South Pisgah Lava
RAN-128 CA-SBR-13064	Lithic Scatter/Lithic Reduction	Prehistoric	Very Low	South Pisgah Lava

Site No.	Site Type	Cultural Context	Potential for Buried Deposits Based on Geomorphologic Information	Project Area Location & Landform
RAN-131 CA-SBR-13065	Lithic Scatter/Lithic Reduction	Prehistoric	Moderate	South Axial Channel
RAN-138 CA-SBR-13066/H	Lithic Scatter/Historic Artifacts	Prehistoric/ Historic	Very Low	South Pisgah Lava
RAN-139 CA-SBR-13067	Lithic Scatter/Lithic Reduction	Prehistoric	Very Low	South Pisgah Lava
RAN-146 CA-SBR-13068	Lithic Scatter	Prehistoric	Very Low	South Inset fan
RAN-154 CA-SBR-13069	Lithic Scatter	Prehistoric	Very Low	South Inset fan
RAN-155 CA-SBR-13070	Lithic Scatter/Lithic Reduction	Prehistoric	Low	South Pisgah Lava
RAN-163 CA-SBR-13071	Lithic Scatter/Lithic Reduction	Prehistoric	Very Low	South
RAN-168 CA-SBR-13072	Lithic Scatter	Prehistoric	Moderate	South Axial Channel
RAN-169 CA-SBR-13073	Lithic Scatter	Prehistoric	Moderate	South Alluvial Fan
RAN-170 CA-SBR-13074	Lithic Scatter	Prehistoric	Moderate	South Alluvial fan
RAN-171 CA-SBR-13075	Lithic Assemblage	Prehistoric	Good	South Axial Channel/ Alluvial fan
RAN-173 CA-SBR-13076	Lithic Scatter/Lithic Reduction	Prehistoric	Low	South Pisgah Lava
RAN-175 CA-SBR-13077	Lithic Scatter	Prehistoric	Low	South
RAN-177 CA-SBR-13078	Lithic Scatter	Prehistoric	Moderate	South
RAN-179 CA-SBR-13079	Lithic Scatter	Prehistoric	Low	South Pisgah Lava
RAN-180 CA-SBR-13080	Lithic Scatter	Prehistoric	Moderate	South Axial channel
RAN-181 CA-SBR-13081	Lithic Scatter	Prehistoric	Moderate	South Axial channel
RAN-183 CA-SBR-13082	Lithic Scatter/Lithic Reduction	Prehistoric	Very Low	South Pisgah Lava
RAN-186 CA-SBR-13083	Lithic Scatter	Prehistoric	Very Low	South Inset channel

Site No.	Site Type	Cultural Context	Potential for Buried Deposits Based on Geomorphologic Information	Project Area Location & Landform
RAN-188 CA-SBR-13084	Lithic Scatter	Prehistoric	Low	South Pisgah Lava
RAN-190 CA-SBR-13085	Lithic Scatter/Lithic Reduction	Prehistoric	Low	South Pisgah Lava
RSS-005 CA-SBR-13086	Lithic Scatter/Lithic Reduction	Prehistoric	Low	South Pisgah Lava
RSS-006 CA-SBR-13087	Lithic Scatter	Prehistoric	Low	South Pisgah Lava
RSS-008 CA-SBR-13088	Lithic Scatter/Lithic Reduction	Prehistoric	Low	South Pisgah Lava
RSS-009 CA-SBR-13089	Lithic Scatter	Prehistoric	Low	South Axial channel
RSS-011 CA-SBR-13090	Lithic Scatter/Lithic Reduction	Prehistoric	Low	South Pisgah Lava
RSS-013 CA-SBR-13091	Lithic Scatter/Lithic Reduction	Prehistoric	Low	South Axial channel
RSS-014 CA-SBR-13092	Lithic Scatter/Lithic Reduction	Prehistoric	Low	South Pisgah Lava
RSS-017 CA-SBR-13093	Lithic Scatter/ Lithic Reduction/ Rock Feature	Prehistoric	Low	South Pisgah Lava
RSS-018 CA-SBR-13094	Lithic Scatter	Prehistoric	Low	South Pisgah Lava
SGB-024 CA-SBR-13098	Lithic Scatter/Lithic Reduction	Prehistoric	Low	South Pisgah Lava
SGB-032 CA-SBR-13099	Lithic Scatter/Lithic Reduction	Prehistoric	Low	South Axial Channel
SGB-034 CA-SBR-13100	Lithic Scatter	Prehistoric	Low	South Alluvial Fan
SGB-036H CA-SBR-13101H	Historic Privies and trash scatter	Historic	Low	South Alluvial Fan
SGB-037 CA-SBR-13102	Lithic Scatter	Prehistoric	Very Low	South Inset Fan
SGB-038 CA-SBR-13103	Lithic Scatter	Prehistoric	Very Low	South Alluvial Fan
SGB-112\H CA-SBR-13108/H	Lithic Scatter/Lithic Reduction Historic Trash	Prehistoric Historic	Moderate	South Pisgah Lava
SGB-114 CA-SBR-13109	Lithic Scatter	Prehistoric	Low	South Pisgah Lava
SGB-118 CA-SBR-13110	Lithic Scatter	Prehistoric	Very Low	South Pisgah Lava

Site No.	Site Type	Cultural Context	Potential for Buried Deposits Based on Geomorphologic Information	Project Area Location & Landform
SGB-120 CA-SBR-13111	Lithic Scatter	Prehistoric	Low	South Pisgah Lava
SGB-127 CA-SBR-13112	Lithic Scatter	Prehistoric	Low	South Pisgah Lava
KRM-131 CA-SBR-13120	Lithic Scatter/Lithic Reduction	Prehistoric	Very Low	South
KRM-133 CA-SBR-13121	Lithic Scatter/Lithic Reduction	Prehistoric	Low	South
KRM-165 CA-SBR-13122	Lithic Scatter	Prehistoric	Low	South Inset fan
EJK-004 CA-SBR-13124	Lithic Scatter	Prehistoric	Low	South Relict Alluvial Flat
EJK-005 CA-SBR-13125	Lithic Scatter	Prehistoric	Low	South Relict Alluvial Flat
EJK-009 CA-SBR-13126	Lithic Scatter/Lithic Reduction	Prehistoric	Low	South Relict Alluvial Flat
EJK-021 CA-SBR-3076	Lithic Scatter	Prehistoric	Low	South Relict Alluvial Flat/ Insert Fan
RAN 102 CA-SBR-4681	Lithic Scatter/Lithic Reduction	Prehistoric	Very Low	South Inset Fan
RAN-189 CA-SBR-5600	Lithic Scatter/Lithic Reduction	Prehistoric	Low	South Pisgah Lava
DRK-180 CA-SBR-5976	Lithic Scatter/Lithic Reduction	Prehistoric	Low	South
RSS-020 CA-SBR-6528	Lithic Scatter/Lithic Reduction	Prehistoric	Low	South Inset Fan
CA-SBR-6521	Lithic Scatter/Lithic Reduction	Prehistoric	Low	South
SGB-112/H	Lithic Scatter/Trash and Refuse Scatter	Prehistoric Historic	Moderate	South Pisgah Lava
CA-SBR-1908/H	Lithic Scatter/Lithic Reduction/150+stone mounds/Historic Trash Scatter/National Old Trails Road	Prehistoric Historic	Moderate in certain sectors	South Pisgah Lava/Inset Fan

C.3.4.11 THIRD-PARTY REVIEW OF ARCHAEOLOGICAL FIELD SURVEY

The resources described and depicted in Table 5 above are the result of URS' initial field inventory/recordation effort of the entire Calico Solar Project APE (Glenn and Nixon 2009). As part of a third-party review of the URS field inventory, the BLM (Barstow Field

Office) retained a third-party reviewer, LSA Associates, Inc. (LSA), in August 2009, to conduct ground-truth visits to a sample of the URS-recorded resources. Utilizing the printed DPR forms prepared by URS, as well as Trimble GPS units with Geographic Information Systems (GIS) digital data containing each site's boundaries and internal features, LSA conducted the task of verifying the DPR forms, recorded site boundaries, feature locations, and artifact classes at 28 (20%) of the 139 archaeological sites recorded by URS. The results of this ground-truthing effort conducted by LSA revealed errors in the initial URS resource recordation effort. The BLM and the Energy Commission, therefore, determined that a re-recordation effort of the cultural resources within project APE was warranted in order to provide a finer resolution of data that would better support this Staff Assessment.

C.3.4.12 RE-RECORDATION OFA 25 PERCENT SAMPLE OF ARCHAEOLOGICAL SITES IN PROJECT APE

Based on the results of the original 20% site revisit, LSA was then subsequently tasked by BLM-Barstow and the Energy Commission to design a field strategy for the re-recordation of an approximately 25% sample of the sites in the APE. As requested by BLM-Barstow and Energy Commission staff, the sample of sites identified for the re-recordation effort were randomly selected and stratified according to landform by LSA from the 139 archaeological sites initially identified by URS (Glenn and Nixon 2009). The intent of the field strategy developed by LSA was to provide a framework in which the resources could be adequately characterized and documented. URS was then tasked with re-recording the 25% sample of sites in accordance with the field strategy developed by LSA. It is intended that the remaining 75% of the sites within the APE would also be subject to re-recordation; however, due to time constraints, the remaining 75% re-recordation effort of sites in the APE will be addressed as part of the terms and conditions of the Programmatic Agreement.

Results of 25% Re-recordation Effort

A total of 38 archaeological sites were revisited and revised as part of the 25% sample re-recordation effort. The site areas of the 25% sample sites were re-examined in 3-meter intervals. As a result of the site revisits, the boundaries of some sites were expanded based on field observations, and in some cases, the site areas increased approximately 100% as compared to the previously recorded site boundaries. Most of the site boundary expansion was the result of the combination of one or more smaller sites with the randomly selected 25% sample sites. In addition, 10 new unrecorded cultural resources that were overlooked during the initial survey effort were also identified during the 25% sample site revisits, including four prehistoric sites with "rock piles" of unknown function and six historic campsites and artifact scatters along the edges of the National Old Trails Road (NOTR), which transects the project from east to west. The results of the 25% sample revisits, amounting to a total of 43 sites, are presented in Table 6 below.

Cultural Resources Table 6
Cultural Resources Inventory for the Project Area of Analysis
(25% sample of archaeological resources and
100% of ethnographic and built-environment resources)

Cultural Resource Classification and Designation(s)	Resource Type	Description*	Project Area Location	Landform Context
Archaeological Resources *Prehistoric Archaeological Resources*				
KRM-135 CA-SBR-13033	Lithic Scatter/ Lithic Reduction	Prehistoric	South	Inset fan/ Relict alluvial fan
KRM-137 CA-SBR-13034	Lithic Scatter	Prehistoric	South	Inset fan/ Relict alluvial fan
KRM-153 CA-SBR-13036	Lithic Scatter	Prehistoric	South	Inset fan/ Relict alluvial fan
KRM-131 CA-SBR-13120	Lithic Scatter/ Lithic Reduction	Prehistoric	South	inset fan
KRM-133 CA-SBR-13121	Lithic Scatter/ Lithic Reduction	Prehistoric	South	Inset fan
EJK-005 CA-SBR-13125/H	Lithic Scatter	Prehistoric	South	Relict alluvial fan
RSS-006 CA-SBR-13087	Lithic Scatter	Prehistoric	South	Pisgah lava
RSS-008 CA-SBR-13088	Lithic Scatter/ Lithic Reduction	Prehistoric	South	Pisgah lava
RSS-011 CA-SBR-13090	Lithic Scatter/ Lithic Reduction	Prehistoric	South	Pisgah lava
SGB-114 CA-SBR-13109	Lithic Scatter	Prehistoric	South	Pisgah lava
SGB-118 CA-SBR-13110	Lithic Scatter	Prehistoric	South	Pisgah lava
SGB-127 CA-SBR-13112	Lithic Scatter	Prehistoric	South	Pisgah lava
DRK-150 CA-SBR-13009	Lithic Scatter	Prehistoric	South	Inset fan
DRK-155H CA-SBR-13012H	Trash Scatter	Historic	South	Alluvial fan
DRK-166 CA-SBR-13015	Lithic Scatter/ Lithic Reduction	Prehistoric	South	Pisgah lava
DRK-170 CA-SBR-13018	Lithic Scatter/ Lithic Reduction	Prehistoric	South	Pisgah lava

Cultural Resource Classification and Designation(s)	Resource Type	Description*	Project Area Location	Landform Context
DRK-171 CA-SBR-13019	Lithic Scatter	Prehistoric	South	Pisgah lava
KRM-028 CA-SBR-13032	Trail	Prehistoric	North	Alluvial fan
RAN-114 CA-SBR-13059	Lithic Scatter/ Lithic Reduction	Prehistoric	South	Pisgah lava
RAN-163 CA-SBR-13071	Lithic Scatter/ Lithic Reduction	Prehistoric	South	Pisgah lava
RAN-169 CA-SBR-13073	Lithic Scatter	Prehistoric	South	Alluvial fan
RAN-175 CA-SBR-13077	Lithic Scatter	Prehistoric	South	Axial Channel
RAN-177 CA-SBR-13078	Lithic Scatter	Prehistoric	South	Pisgah Lava
RAN-011 CA-SBR-13053	Lithic scatter	Prehistoric	North	Alluvial fan
RAN-110 CA-SBR-13058	Lithic Scatter	Prehistoric	South	Inset fan
DRK-133 CA-SBR-13001	Lithic scatter	Prehistoric	South	Pisgah Lava/Inset Fan
DRK-140 CA-SBR-13005	Lithic Scatter	Prehistoric	South	Inset fan
DRK-182 CA-SBR-13026	Lithic Scatter/ Lithic Reduction	Prehistoric	South	Pisgah Lava
KRM-003 CA-SBR-13029	Lithic Scatter	Prehistoric	North	Alluvial fan
KRM-170 CA-SBR-13041	Lithic Scatter/ Lithic Reduction/ Rock Feature	Prehistoric	South	Inset fan
LTL-009 CA-SBR-13043	Lithic Scatter/ Lithic Reduction	Prehistoric	South	Pisgah lava
RAN-025 CA-SBR-13054	Lithic scatter	Prehistoric	North	Alluvial fan
RAN-107 CA-SBR-13057	Lithic Scatter	Prehistoric	South	Inset fan
RAN-154 CA-SBR-13069	Lithic Scatter	Prehistoric	South	Inset fan
RAN-183 CA-SBR-13082	Lithic Scatter/ Lithic Reduction	Prehistoric	South	Pisgah lava

Cultural Resource Classification and Designation(s)	Resource Type	Description*	Project Area Location	Landform Context
SGB-013 CA-SBR-13096	Lithic scatter	Prehistoric	North	Alluvial Fan
DRK-112H	Rock cairn	Prehistoric	South	Relict alluvial fan
KRM-141 CA-SBR-13035	Lithic Scatter	Prehistoric	South	Inset fan/ Relict alluvial fan
CA-SBR-6512/CA-SBR6513 (SGB-028)	Lithic Scatter/ Lithic Reduction/ Stone Mounds	Prehistoric	South	Inset fan
RAN-155 CA-SBR-13070	Lithic Scatter/ Lithic Reduction	Prehistoric	South	Pisgah lava
Multiple Component Archaeological Resources				
SGB-112\H CA-SBR-13108/H	Lithic Scatter/ Lithic Reduction Historic Trash	Prehistoric Historic	South	Pisgah lava
DRK-176/H CA-SBR-13023H	Lithic Scatter Trash Scatter	Prehistoric Historic	South	Axial channel
KRM-154	Lithic Scatter	Prehistoric	South	Inset fan/ Relict alluvial fan

*See Appendix A for complete archaeological site descriptions.

Re-Recordation of Remaining 75% of Sites in the APE

As mentioned above, the re-recordation of the remaining 75% of sites in the APE will be completed in accordance with the PA. Based on a Data Request from BLM and Energy Commission staff, approximately 107 additional sites will be revisited. The site revisit task is ongoing at the time of the preparation of this document.

C.3.4.13 DISCUSSION OF RESULTS OF ARCHAEOLOGICAL SURVEYS

The environment and soils in the northern section of the project area differ from those in the southern section. The two sections are approximately delineated by the existing railroad line. The majority of cultural resources are observed in the southern portion and the ground surface is covered by developing and well developed desert pavement. This area has been affected by aeolian erosion forces and appears to exhibit potential for buried deposits. The northern portion contains alluvial and colluvial sediments on an extensive fan system that experiences substantial surface sheet wash.

Prehistoric site types consist of lithic reduction sites composed of local materials exhibiting basic flake and cobble technology. Unless otherwise noted, the lithic scatters did not include temporally diagnostic artifacts or features. Some of these sites contain numerous rock pile features of unknown function. Historic site types include transportation and mining related remains.

Historical Significance of the Cultural Resources Inventory

State and Federal regulatory programs require the BLM and the Energy Commission to consider the potential effects of the proposed action on historically significant cultural resources. Under the subject programs (CEQA, NEPA, and Section 106), formal evaluations of historical significance conclude the process of identifying which cultural resources in the inventory for the proposed action must be given further consideration. Cultural resources that can be avoided by construction may remain unevaluated. Unevaluated cultural resources that cannot be avoided are treated as eligible when determining effects. The early phases of the typical planning process often results in the development of a preliminary cultural resources inventory that includes more resources than a proposed action would ultimately affect, because the preliminary inventory cannot take into account the final design of the facility. Whereas efforts are on-going to design construction to avoid cultural resources, for the purpose of the present analysis, staff here assumes that the construction, operation, maintenance, and decommissioning of the proposed action may wholly or partially destroy all archeological sites on the surface of the project area. As a result, staff recommends that all known cultural resource in the project area of analysis be subject to formal evaluations of historical significance.

The time required for formal evaluations of historical significance for the complete cultural resources inventory would exceed the one-year licensing process. The Energy Commission staff has not been able to complete evaluations of the historic built environment resources and all archaeological resources in the project area of analysis; therefore, resource evaluations will occur subsequent to BLM and Energy Commission decisions on the proposed action pursuant to terms of a Programmatic Agreement. This subsection provides basic descriptions of the 25% inventory sample of archaeological resources, preliminary identifications of the archaeological landscapes and districts to which the archaeological resources may contribute, preliminary identifications of the archaeological site types that may be useful in evaluating the historical significance of whole groups of archaeological sites, and basic descriptions of the individual archaeological sites that do not appear to be elements of any archaeological landscape or district or do not conform to any identified site type. Each archaeological resource discussion will conclude, where appropriate, with a preliminary statement on the potential historical significance of each potential landscape, district, type, or particular resource. Discussions of probable effects to the full range of significant cultural resources will be made in the “Assessment of Impacts and Discussion of Mitigation” subsection below. As noted above, staff is participating in the development of a Programmatic Agreement (PA). One of the purposes of the PA is to identify the analytical processes that will be used to determine the significance of cultural resources and ensure appropriate mitigation for any impacts to those resources.

Archaeological Resources

Cultural Resources Table 8
Absolute and Relative Frequencies of the Landform Distribution of Whole Archaeological Resources and Components of Archaeological Resources in the Northern and Southern Sections for the Proposed Action Based on 25% Re-survey Results

Resource or Resource Component Classification and Type	Resource or Resource Component by Landform Context Northern Section (north of railroad)				
Prehistoric Archaeological Resources*	Rock Outcrops	Upper Alluvial Fan Piedmont (N=4)	Lower Alluvial Fan Apron		
Lithic Scatter		4			
Trail Segments		1			
Historical Archaeological Resources	Rock Outcrops	Upper Alluvial Fan Piedmont	Lower Alluvial Fan Apron		
None					
Resource or Resource Component Classification and Type	**Resource or Resource Component by Landform Context Southern Section (south of railroad)**				
Prehistoric Archaeological Resources*	Pisgah Lava (N=14)	Erosional Fan Remnant (NA)	Inset Fans (N=16)	Relict Alluvial Flat (N=13)	Axial Channel (N=1)
Lithic Scatter	14		16	13	1
Rock Features			2		
Historical Archaeological Resources	Pisgah Lava (N=1)	Erosional Fan Remnant (NA)	Inset Fans (NA)	Relict Alluvial Flat	Axial Channel (N=1)
Historic refuse deposit	1			N/A	1

*"Deposit" is a broad term that encompasses both diffuse artifact scatters and diffuse scatters that include periodic artifact concentrations.

Prehistoric Archaeological Resources. This analysis takes into consideration a total of 43 prehistoric archaeological resources (see Table 6). These resources consist of 42 archaeological sites and one prehistoric trail segment that are the result of the 25% sample of the cultural resources inventory for the project area of analysis/APE. The total number of sites is slightly greater than 25% because of the previously individual sites that were integrated with other sites as a result of the re-recordation effort (see Cultural Resources Table 7, above). The archaeological sites and prehistoric trail segment have been sorted into archaeological resource or site types (see Cultural Resources Table 8, above), and then sorted below into 3 site type groups, lithic scatters (N=40), historic deposits (N=2), and trail segments (N = 1). This subsection provides basic descriptions, interpretations, and, where appropriate, preliminary statements on the potential historical significance of each district and site type group.

Preliminary Comment on the Historical Significance of Prehistoric Archaeological Resources

Site Types and Site Type Groups

Lithic Scatter. The lithic scatter site type group includes chipped stone deposits, sparse chipped stone deposits, sparse chipped stone and angular jasper deposits, and "angular rock" concentrations in association with sparse chipped stone deposits. The absolute majority of the archaeological deposits in this site type group are found on the Pisgah Lava, Insert Fan, and Relict Alluvial Flat landforms where they make up the relative majority of site types on those landforms. The site type group largely appears to represent the procurement of stone suitable for the production of chipped stone artifacts and the early stages of production (including lithic reduction) of expedient flake tools through hard hammer percussion techniques, although the finished tools are seldom found at sites in the project area of study. The proposed PA would provide the opportunity to consider whether and how the relative ages of the archaeological deposits of this site type group may be determined, and whether and how behavioral associations may be made among these deposits and other prehistoric archaeological deposits in the project area. Determinations on the historical significance of the deposits in the site type group would rely on the outcomes of these considerations.

Prehistoric Trail Segments. The 25% sample of the cultural resources inventory for the proposed Calico Solar Project includes what is thought to be one prehistoric trail segment. The functions of trails within the Project area seem to be both related to accessing the desert pavement as a lithic raw materials source in the southern portion of the Project area and as a general route of travel through the area.

The longest, continuous trail identified during the survey phase traverses the Calico Solar Project area in the upper alluvial fan piedmont below the mountain front in the northern section of the project. The trail enters the Calico Solar Project area along its eastern boundary close to 3 miles northeast of the Pisgah Substation and crosses the area between 500 and 1,000 meters down slope of the front of the Cady Mountains and mountain valleys. Sites in this portion of the Project area are subject to high energy events as streams emanate from the mountain valleys and rework sediments in a complex network of braided channels. The effects of this phenomenon are apparent in the segmented nature of the trail.

While the longevity of portions of the trail is compromised by fluviation, the rocky nature of the surface also serves to preserve elevated and stabilized portions of the trail. The dynamic nature of this location makes the choice of positioning the trail difficult to interpret. The actual construction of the trail would take greater energy expenditure, in that clast size is much larger at this position in the landscape than further down the bajada slope. Typical clasts can be as large as small boulders. Impacts to the trail by flood events would demand that the trail be frequently repaired. Transecting the valley near the base of the mountains, where many channels are incised into the fan sediments, would be difficult and would require more energy. Conversely, further down the valley, near the axial channel on the fan apron of the alluvial piedmont, where travel might be easier, there is a lack of surface rock. Therefore, evidence of trails in this region would not be preserved or apparent during a surface survey. In addition to eolian deposition, sheet wash and constant down-cutting by runoff from the upper portion of the alluvial fan piedmont would alter the surface sediments and render the trails undetectable. Thus, conjecture about trails in this region of the Project area is not really feasible.

Rock Feature Concentrations. There is an unusually high density of rock features in the project APE and they occur in groups of 20 or more. The features are built from various sizes of round and angular pebbles and cobbles from the immediate area. They include cairn and rock mound features. The primary association of the features is with landscape surfaces from which surface boulders and rocks have been cleared. The primary artifact association of the rock features in the project is with prehistoric flakes and fragments, although not all features have them. Associations with historic artifacts are limited to the margins of the National Old Trails Road or other historic roads. The archaeological deposits of this site type are found exclusively on the Insert Fans and Relict Alluvial Fan Piedmont landforms. It is uncertain from surface inspection, recordation, and review of the pertinent literature whether the rock features are all prehistoric, all historic, or both. The behavioral interpretation of the site type, and determinations on the historical significance of the deposits would be made under provisions in the proposed PA and would rely on the interpretations ultimately derived for them.

Potential Prehistoric Archaeological Landscape. Data Request 106 asked whether a major portion of the Calico Solar Project area represents a part of a prehistoric archaeological landscape or district related to the exploitation of a consequential source of tool stone along the toe of the Cady Mountain bajada and south along the channels with ephemeral streams that drop into Troy Lake.

As was done to evaluate the potential for historic districts, above, URS considered the potential to define a prehistoric archaeological landscape while preparing the responses to cultural resources Data Requests 92 through 105. The potential landscape also was evaluated by reviewing the State of California Department of Parks and Recreation (DPR) forms completed for the individual resources within the potential landscape. The potential eligibility of those resources for the National Register of Historic Places (NRHP) or California Register of Historic Resources (CRHR), as a landscape that would include a large suite of flaked stone artifact scatters was evaluated for their potential to represent a significant and distinguishable entity, even if many of the scatters lack individual distinction. The potential landscape was evaluated using guidelines of the National Park Service and the State of California.

As discussed above, a grouping of cultural resources and their setting must be historically or functionally related and visually convey a historical theme or environment to be considered eligible for listing in the NRHP as a landscape. In addition, the landscape must possess sufficient historical significance and integrity. Clearly, the archaeological resources within the Project area, individually, and as a group, display a functional uniformity. All sites, presumed prehistoric in age, were used primarily, if not exclusively for exploitation of the tool stone that is ubiquitous on the desert pavements within the bolson. For this reason, the sites are inherently and directly linked to the landscape. Thus, the bolson in which the Project area is situated can be characterized as an archaeological landscape.

The mere presence of an archaeological landscape, does not, alone, qualify it for listing on the NRHP or CRHR. Several other criteria must be met for register eligibility. These are examined and evaluated, below.

The boundaries of a district or landscape “must be a definable geographic area that can be distinguished from surrounding properties by changes such as density, scale, type, age, style of sites, buildings, structures and objects, or by documented differences in patterns of historic development or associations” (U.S. Department of the Interior, National Park Service 2002:6). While distinctive for the direct relationship between tool stone and archaeological evidence of utilization of these lithic resources, the archaeological landscape within the Project area cannot be well-bounded, nor can it be distinguished from similar landscapes that occur throughout this portion of the Mojave Desert. The portion of the Calico Solar Project area that contains the majority of the lithic reduction sites is south of the axial channel, where sedimentary deposits are composed of a series of uplifted Pleistocene fan remnants and younger inset fans. Cryptocrystalline silicates, including jasper and chalcedony, basalts, andesite, and other volcanic materials constitute the majority of the desert pavement. The pavement occurs on the eroding fan remnants and the inset fans, as well as on relict portions of the alluvial flat. These desert pavements provide a ready source of high quality tool stone. However, such rich sources of tool stone are not confined to the project area, nor are they unique.

The source of the tool stone is thought to be fanglomerate and gravel (Qof) and volcanic fanglomerate (Tvf) as mapped by Diblee (2008), which are not confined to the Project area or vicinity. Thus, the tool stone source and landscape is not well bounded. Furthermore, similar formations, with equally high quality tool stone occur throughout the southern California deserts. Like the sources in the Project area, these were utilized throughout prehistory. Thus, the archaeological landscape in the Project area is not sufficiently bounded nor distinguished from surrounding areas to meet NRHP standards. Furthermore, the characteristic theme of the archaeological landscape cannot be dated. Only a handful of temporally diagnostic artifacts have been recorded among the lithic reduction sites. It is presumed, but unknowable, that this tool stone source was utilized throughout prehistory. Therefore, this archaeological landscape does not have the distinctive or significant qualities required for eligibility under Criterion C/3.

Again, the lack of datable material at the sites within the Project area precludes their consideration for eligibility under Criteria A/1 and B/2. Both criteria require information that could link the landscape with particular events and trends, or with historically significant people. Absent information about who used these sites, and when they were used, neither of these criteria can be met. Further, the registers require that a period of significance be identified for the district or landscape.

Finally, the lack of datable material also severely limits the utility of the assemblages to address important research issues. Data from the lithic reduction sites in the Calico Solar Project area can address only two, fairly insignificant questions: what materials were being exploited and what reduction residue was produced? These are insignificant because:

(1) the source material is well-documented and obvious, and (2) debris from lithic reduction is of predictable forms that can inform on the methods and products of reduction, unless, as is the case in the Project area, assemblages from different reduction episodes may be mixed. Components must be well dated to provide information about trends in resource procurement, artifact/tool forms, and technological changes through time. In fact, for a number of reasons, these issues can be addressed much more productively using data from sites where the tool stone was taken and used. First, the source locality only bears the residues of reduction, while the use site will bear evidence of the forms in which the stone arrived, and the types of tools manufactured. Second, diachronic changes in technology are best addressed using data from destination sites where components are well-dated, not at mixed tool stone procurement sites. Third, the presence of certain source materials in destination/use sites provides an indication of the direction and distances the materials traveled, either through trade or direct procurement; source sites rarely bear evidence of who used the tool stone. Lastly, destination sites that are well-dated, typically bear other artifacts and ecofacts that can inform on reasons why patterns of lithic resource procurement may change through time (e.g., climate change, resource stress, technological change, circumscribed territories, etc.). In sum, the lithic reduction sites and landscape do not have sufficient data potential to qualify for listing under Criterion D/4.

Preliminary Comment on the Historic Significance of Historic Resources

Historical Archaeological Resources

Site Types and Site Type Groups

Historic Refuse Deposits. The historic refuse deposit site type group includes historic refuse deposits. The archaeological deposits in this site type group are found on the Pisgah Lava, Relict Alluvial Flats, and Axial Channel landforms where they make up 27%, 50% and 100% of the historical archaeological site types, respectively. The behavioral interpretation of the site types in this group, and determinations on the historical significance of the deposits would be made under provisions in the proposed PA and would rely on the interpretations ultimately derived for them.

Built-Environment Resources. The proposed action appears to have the potential to affect each of the 8 built-environment resources in the project area of analysis (see Cultural Resources Table 7, above), none of which staff recommends as eligible for either the NRHP or the CRHR. The built-environment resources inventory includes cultural resources that represent the themes of: electric energy transmission (Pisgah Triangle Sub-station, Southern California Edison 12-Kilovolt Transmission Line); transportation (Hector Road and the National Old Trails Road, including associated locations of gravel mining, artifact concentrations and activity areas such as rest stops); natural gas energy transmission (Pacific Gas and Electric Pipeline and the Mojave National Gas Pipeline); and aviation (SGB-112/H).

- **Hector Road.** Four segments of Hector Road were recorded within the Calico Solar Phase 1 and Phase 2 project areas. The Hector Road interchange off of Interstate 40 provides access to the project area. Hector Road extends for a short distance south of Interstate 40 to U.S. Route 66. North of Interstate 40, Hector Road has been realigned since its original construction, and much of the historic segment of the road between Interstate 40 and the BNSF is not within the Calico Solar project area. The road in the vicinity of the Interstate 40 interchange is a two-lane paved roadway. North of the Interstate 40 interchange, Hector Road is reduced to one-lane, graded, dirt roadway. An improved railroad crossing has been constructed at Hector Road, which remains locked with a gate and padlock and is only used by local traffic with access permission. The improved crossing includes crossing arms and slightly sloped asphalt ramps that bring the road up to railroad grade and back down to road grade level.

From the BNSF, Hector Road continues northward about 1 mile to the northwest corner of Section 3, Township 8 North, Range 6 East, and then continues eastward along the section line for 3 miles. At the northeast corner of Section 1, Township 8 North, Range 6 East, Hector Road turns to the southeast and continues across sections 6 and 8 until its junction with the SCE 220-kV transmission line road. This segment of the road is a one-lane, graded dirt road that appears to be maintained and frequently used. The route of Hector Road from the railroad to the transmission line road has not been modified since its original construction in the late 1930s or early 1950s. Sometime after 1955, Hector Road was extended about 0.5 mile southeast to a road that leads to the Black Butte manganese mine. Hector Road likely was constructed to provide access to mines in the project vicinity. The road also could have been used to transport construction materials to the SCE 220-kV transmission line and the Pisgah Substation from the railroad.

Hector Road is not associated with any distinctive or significant event, person, design, or construction, and all data potential has been accounted for during the recordation process. The road is representative of typical construction, which has been well-documented in California and the West. Therefore, based on site investigations and historic research, Hector Road is recommended not eligible for the National Register and is not a historic resource pursuant to California Register under any of criterion for eligibility.

Based on site investigations and historic research, Hector Road is recommended not eligible for listing in the NRHP and CRHR. Hector Road is a modest example of a typical one-lane dirt graded rural road. It is not associated with any distinctive or significant events, persons, design/construction, or has the potential to yield important information about the past. The road is representative of typical construction, which has been well-documented in California and the West.

- **Pacific Gas and Electric and Mojave Pipelines.** The Pacific Gas and Electric Pipeline and the Mojave Pipeline are natural gas pipelines that run through the Solar 1 Phase 2 project area. Both of these pipelines were constructed prior to 1955, but there are no visible features of either pipeline in the Calico Solar Project Area. In addition, the Advisory Council on Historic Preservation has exempted federal agencies from taking into account the effects of their undertakings on historic natural gas pipelines (Advisory Council on Historic Preservation 2002). A brief history of these pipelines is provided in Section 3. The two pipelines would not be affected by the proposed project, and they are recommended as not eligible for the NRHP or CRHR under any criteria. DPR 523 forms were not completed for either pipeline.
- **National Old Trails Road [CA-SBR-2910H].** The National Old Trails Road in the project area includes eight remnant segments of a batched mix oil road. The

condition of the road segments is poor — most of the road surface is crumbled and cracked, and in places has eroded. Some segments are buried in sand, but may be partially intact. The National Old Trails Road was designated by highway “booster” organizations in 1912, and by the late 1920s much of the highway was either oiled or surfaced with gravel. In 1926, the National Old Trails Road was designated as U.S. Route 66, but in the 1930s, it was abandoned in favor of a route to the south, which is the current alignment of historical U.S. Route 66. Both the National Old Trails Road and 1930s alignment of U.S. Route 66 have been recorded under site number CA-SBR-2910H. Because remnants of both the 1912 alignment of the National Old Trails Road and the 1930s alignment of U.S. Route 66 are located within the Solar 1 study areas, separate update forms were completed for the National Old Trails Road and U.S. Route 66. In the 1970s, the Bureau of Land Management recorded a segment of the 1912-era National Old Trails Highway as part of the California Desert Project, and a segment of the 1930s U.S. Route 66 within the Eastern Mojave Planning Unit. The CA-SBR-2910H site form was updated during a survey for the All American Pipeline replacement project in 2001, in which the 1930s alignment was recorded. As a whole, the National Old Trails Road is significant as an early automobile transportation route across the Mojave Desert and as an early route for the historically significant U.S. Route 66 and is considered eligible for the NRHP and CRHR under Criterion A/1.

The eight segments of National Old Trails Road in the project APE are isolated, segmented, in generally poor condition, and retain little integrity. Research did not reveal any associations with distinctive or significant person, event, persons, design, or construction, and all data potential has been accounted for during the recordation process. These segments of National Old Trails Road in the Calico Solar Project APE is a typical example of an early automobile roadway and data potential is considered exhausted through recordation. Therefore, the eight segments of National Old Trails Road within the APE are recommended as contributing elements to the existing historic property for the National Register and as a historic resource pursuant to California Register under any of the criterion for eligibility. It is also recommended that additional research address the gravel mining associated with the construction of the National Old Trails Road and at the site of the possible associated rest stop at site RSS-017.

- **Southern California Edison 12-Kilovolt Transmission Line.** The SCE 12-kilovolt transmission line was constructed in 1961 as a rural distribution line. The line within the Calico Solar Project Area consists of fifteen 40-foot-tall utility poles, which are each 0.75 foot in diameter. The poles have a single T-post on the top with 3 ceramic insulators and 3 transmission lines. The poles are creosote-treated pine and each pole features an identification tag and an embossed nail on the left for height (40) and an embossed date nail (61) on the right. There also is an associated 207-foot-long historic transmission road and sparse historic trash in the vicinity of the transmission line.

  The 12-kv transmission line is not associated with any distinctive or significant event, persons design or construction, and all data potential has been accounted for during the recordation process. The 12-kv transmission line is modest example of a pine T-post utility pole transmission, of typical construction, which has been well-documented in the California and the west. Therefore, based on site investigations and historic research, the SCE 12-kilovolt transmission line is recommended not eligible for the National Register and is not a historic resource pursuant to California Register under any of criterion for eligibility.

- **Southern California Edison 220-Kilovolt North and South Transmission Lines.** The SCE 220-kilovolt North and South Transmission Lines are single-circuit transmission lines with lattice steel, wedge A-frame and metal-waisted tower structures. The evenly-spaced tower structures are approximately 75-feet-tall and include 3 conductor wires, 2 static wires, and insulators. Each Tower (within the Project APE) structure has four legs, which are anchored in concrete footings. The transmission lines are located in a rural setting on property managed by the BLM. The transmission lines originate at the SCE switchyard at the Hoover Dam and terminate in Chino, California. Two approximately 4.7-mile segments of the transmission lines were recorded within the Pisgah Substation Triangle area and the historic built-environment 0.5-mile buffer. A historic context is presented below.

  Construction the Hoover Dam started in 1931 and was completed in 1935. Power production for community use began in 1936 when power was delivered to the cities of Los Angeles, Pasadena, Glendale, and Burbank through three parallel transmission lines constructed by the Los Angeles Bureau of Power and Light (currently Los Angeles Department of Water and Power). The Los Angeles Bureau of Power and Light transmission lines were determined to be eligible for the NRHP and were formally nominated for listing in the NRHP in 2000, but apparently were not listed (Federal Highway Administration 2005; Hughes 1993; Myers 1983).

  The second company to distribute Hoover Dam power was the Nevada-California Corporation. The power was conveyed by a 132-kilovolt transmission line that had been originally constructed in 1930 and 1931 to deliver power to the dam site during construction (which has been recorded as CA-SBR-10315H]). This transmission line includes two-legged, prefabricated steel towers with angle cross arms, in contrast the four-legged lattice towers used in the SCE North transmission line. This transmission line also is known as the Edison Company Boulder Dam-San Bernardino Electrical Transmission Line and has been determined eligible for the NRHP and is listed in the CRHR (Hatheway 2006; Myers 1983).

  The Metropolitan Water District of Southern California was the next to distribute electrical power in 1938. This transmission line, known as the Metropolitan Water District Line, used technology similar to that used previously by SCE for 220-kilovolt transmission lines in southern California. Utilities companies in southern California, such as the Pacific Light and Power Company (which merged with SCE in 1917) and SCE were known as innovators in the development of high voltage systems. In 1926, Stanford University established a high-voltage laboratory and worked with Pacific Gas and Electric and SCE in research and development. Through this collaboration insulators for California's 220-kilovolt lines were developed. The Metropolitan Water District Line has been determined eligible for the NRHP under Criterion A for its association with Hoover Dam (Hughes 1993; Myers 1983; Schweigert and Labrum 2001).

  The SCE 220-Kilovolt North Transmission Line was constructed between 1936 and 1939, using the same design and technology SCE had been using for its existing high-voltage transmission lines in southern California (including its Vincent 220-

kilovolt line), and the design used by the Metropolitan Water District for its Hoover Dam line. The transmission line began receiving power from the Hoover Dam in 1939, after the completion of Hoover generating units A-6 and A-7 (Myers 1983; Schweigert and Labrum 2001).

When World War II began in Europe, SCE planners anticipated an increase in demand for power in southern California. SCE began construction on a second transmission line, the SCE South 220-Kilvolt South Transmission Line (SCE South or Hoover-Chino No. 2), in 1939. SCE North and SCE South take divergent courses from the SCE switchyard at the Hoover Dam but meet near Hemenway Wash in Nevada and run approximately parallel to each other from north of Boulder City, Nevada to Chino, California. SCE North and SCE South are parallel within the Solar 1 project area. Both SCE North and SCE South delivered electricity that was essential to war-time industries in Southern California. These industries included the Douglas, Vultee, and Northrup aircraft plants, Consolidated Steel, the Long Beach Naval Shipyard, Kaiser Steel, Alcoa, Columbia Steel, as well as automobile factories, tire plants, oil refineries, ordnance works, and military bases and depots (Myers 1983; Schweigert and Labrum 2001).

The SCE 220-Kilovolt North and South Lines are associated with the early operation of Hoover Dam and both played a significant role in providing electricity essential to World War II industries located in southern California. The Los Angeles Bureau of Power and Light transmission lines, the Edison Company Boulder Dam–San Bernardino Electrical Transmission Line, and the Metropolitan Water District Line, all of which provide Hoover Dam power to southern California, have all been determined eligible for the NRHP, and the Edison Company Boulder Dam–San Bernardino Electrical Transmission Line also is listed in the CRHR (Hatheway 2006; Myers 1983; Schweigert and Labrum 2001).

The SCE 220-Kilovolt North and South Lines were previously recorded in Nevada (site numbers 26CK6249 and 26CK6250) during the Boulder City/U.S. 93 Corridor Study, and were determined eligible for the NRHP by the Federal Highway Administration and Nevada State Historic Preservation Office (Federal Highway Administration 2005). Both the Southern California Edison 220-kilovolt North and South Lines are in-use and regularly maintained in the Solar 1 project area, but retain sufficient integrity to be considered for register listing. Because of the association of the transmission lines to the Hoover Dam and their significance in the World War II effort, the SCE 220-Kilovolt North and South Lines are recommended eligible for the NRHP under Criterion A and the CRHR under Criterion 1.

The transmission lines were constructed using the same design and technology SCE had been using for its existing high-voltage transmission lines in southern California. SCE and other southern California utilities companies were known as innovators in high-voltage systems (Hughes 1993). Further study would need to be conducted to determine the significance of the design to southern California utilities and how many examples of this type remain extant to determine if the SCE North and South transmission lines are eligible under Criterion C/Criterion 3.

Research did not reveal any associations with any important persons (Criterion B/Criterion 2) and the transmission line does not have the potential to yield important information (Criterion D/Criterion 4).

- **Pisgah Substation.** The Pisgah Substation is a Southern California Edison switching station that was constructed in 1940 during the construction of the SCE South 220-Kilvolt South Transmission Line and is considered a component of the transmission line (personal communication, Thomas Taylor, Manager, Biological and Archaeological Resources, Southern California Edison, 18 September 2008). It shares its name with the railroad siding of Pisgah and Pisgah Crater, which are located in the vicinity. A switching station is an intermediate station, which has incoming and outgoing power lines of the same voltage. Unlike other substations, a switching station does not transfer power from a higher voltage to a lower voltage, but instead works to control increases and decreases in voltage.

  In addition to the equipment associated with the function of the substation, including switch gears and bus bars, the Pisgah Substation also has three buildings, which house the relay station and battery equipment. The largest of these buildings is a rectangular brick building that faces southeast. The building has steel-frame fixed and casement windows. The main entrance is a single entry door with 15 lights, which is accessed by concrete steps with a metal railing. The hipped roof is clad with asphalt shingles and clay tile along the ridge lines.

  The other two buildings are smaller and appear to be used for storage. The building located at the north corner of the substation is a wood-framed box-shaped structure with a hipped roof that has exposed rafter ends and is clad with clay tile. There is a wood roll-up door on the southeast side of the building, suggesting that it is used to store vehicles or larger equipment. The other building is located adjacent to the wood-framed building and is a brick, box-shaped structure with a hipped roof that has exposed rafter ends and is clad with clay tile. The windows are steel frame casements and the building is accessed by a single entry wood door. All of the buildings are in good condition and appear to be in-use.

  The Pisgah Substation is not associated with distinctive or significant person, and the substation is of a typical design for its era and is not a rare surviving example (personal communication, Thomas Taylor, Manager, Biological and Archaeological Resources, Southern California Edison, 18 September 2008). Although this switching station is associated with the Southern California Edison 220-Kilovolt North and South Lines, which is recommended eligible for the National Register and California Register under Criteria A/1 (see above evaluation). The Pisgah Substation is a component of the transmission line, therefore it also recommended eligible for the National Register and as a historic resource pursuant to California Register under criteria A/1 for eligibility.

- **Pisgah Crater Road.** Pisgah Crater Road currently runs between the SCE 220-kilovolt transmission line road to the Pisgah Crater, a volcanic cinder cone located south of the Project Area. U.S.G.S. 15-minute topographic quadrangles indicate that this road was extended sometime after 1955 because the map only depicts the road between Pisgah Crater south of U.S. Route 66 and a small segment north of U.S. Route 66 that terminates at the BNSF Railway. The segment of Pisgah Crater Road that is historic-age (45 years old or older) is paved with asphalt and is approximately 24 feet wide. The Pisgah Crater currently is being mined for aggregate and is located on private land. The road does not appear to be regularly maintained and likely is only sporadically used to access the mine.

Pisgah Crater Road is not associated with any distinctive or significant event, person, design, or construction, and the data potential has been accounted for during the recordation process. The majority of the road is located on private land and much of the crater has been destroyed by mining. No records were found to indicate that the Pisgah Crater was ever a well-known tourist destination for U.S. Route 66 travelers. The road is representative of typical construction and design, which has been well-documented in California and the west. The Pisgah Crater Road is of common design and construction. Further study of the road is unlikely to yield important information about the past. Therefore, Pisgah Crater Road is recommended as not eligible for listing the National Register and is not a historical resource pursuant to the California Register under any of the criterion for eligibility.

Brief descriptions of the built-environment resources and recommendations on their historical significance are presented below. The information for the descriptions and evaluations is drawn from the applicant's cultural resource technical reports and the applicant's responses to Energy Commission and BLM data requests (SES 2008e, 2009h).

Landscapes

Early Twentieth Century Gravel Mining Landscape. Gravel mining appears to have been a relatively widespread form of land use in the project area from approximately 1900 through the early 1960s. Although much of the gravel mining appears to have been associated with the construction of the National Old Trails Road, no specific archival information has been found regarding the gravel mining operations. This earlier operation, on the basis of the data presently in hand, appears to date from approximately 1900 to 1920 and further appears to have been operated using older, largely non-mechanical gravel mining techniques. These techniques appear to have involved the use of draft animals to pull rakes or scraping sleds across the relatively well-developed desert pavements of the Insert Fans landform to extract the gravel resource. This apparent form of mining has left the mined desert pavements with a distinctive pattern of scarification, linear swaths of the ground surface relatively devoid of gravel and punctuated at somewhat regular intervals with low gravel lag mounds. The scarification pattern permits one to readily delineate the area that was subject to this form of mining.

Staff proposes the designation of a historical archaeological landscape, an industrial landscape that represents the apparent early twentieth century gravel mining operation in the south-central portion of the project area and that it apparently associated with the construction of the National Old Trails Road. The landscape, on the basis of the results of the 25% sample of the cultural resources inventory for the proposed action, presently includes the area that exhibits the distinctive pattern of scarification that was the result of this operation and the historical archaeological component of RSS-017, an apparent early twentieth century rest area alongside the National Old Trails Road. The further inventory of potential contributing elements to the proposed landscape, refinements to the recordation of those elements, and determinations on the historical significance of the landscape as a whole and of the individual contributing elements, both as contributing elements and as stand-alone archaeological resources would be made under provisions in the proposed PA.

Manganese Mining in the Project Vicinity. Three of the 11 documented manganese mines within San Bernardino County are in the Project vicinity — the Logan Mine, Black Butte Mine, and Lavic Mountain Manganese Mine. The Logan Mine is the only one of these within the Project APE.

The Logan Mine (also referred to as the Trans-Oceanic Mine) was not located until early 1930 and its first ore shipment, 71 tons of ore with 44% manganese, was made in 1934. E.F. Logan of Daggett, and later of San Bernardino, owned the mine, which in 1953, consisted of six claims. During 1942 and 1943, Logan leased the mine to Suckow Borax Mines Consolidated Company of Los Angeles. In 1943, the Logan Mine shipped about 300 tons of ore with 40% manganese to the Metals Reserve Company. By the end of 1943, the mine was idle, and no employees were working at the mine. Subsequent to the Suckow lease, the mine produced 200 tons of ore with 19% manganese for the Kaiser Steel Corporation in Fontana. In 1953, the California Division of Mines and Geology reported that the Logan Mine continued to be worked occasionally (Tucker and Sampson 1943; Wright and others 1953).

The California Division of Mines and Geology rated the manganese mines located on the southwest slope of the Cady Mountains in the Project vicinity as third in terms of production in all of San Bernardino County. The New Deal Mine at the south end of the Owlshead Mountains was the largest producer, followed by the mines in the Whipple Mountains. All three mines in the Project vicinity were small operations that were only active during times when manganese was in great demand and prices were high. Of the three mines, the Logan Mine was the most productive. Although work was done at the Lavic Manganese Mine during World War II, no ore was shipped during this era and records indicate only 100 tons of ore was shipped from the mine during World War I. Both the Black Butte Mine and the Logan Mine were active during World War I and World War II. The Black Butte Mine produced approximately 425 tons while the Logan Mine produced more than 700 tons. When compared to the manganese mines county-wide, the manganese mines in the Cady Mountains produced far less manganese ore than those in the Owlshead and Whipple Mountains. The Monument King Mine in the Whipple Mountains reportedly shipped approximately 1,800 tons of ore and the New Deal Mine in the Owlshead Mountains shipped more than 15,000 tons (Tucker and Sampson 1943; Wright and others 1953).

The Logan Mine Site (CA-SBR-4558H) was originally recorded in 1979 and is the archaeological remnants of a surface manganese mining site. It is also referred to as the Trans-Oceanic Mine. The Logan Mine was one of three manganese mines in the Project vicinity, but the only one within the Project APE. E. F. Logan of Daggett, and later of San Bernardino, owned the mine, which by 1953 consisted of six claims. Activity at other mines in San Bernardino County began either in World War I or World War II when the demand for manganese ore was high (manganese is used in making iron and steel and foreign supplies were reduced during the wars). The Logan Mine was located in the early 1930s at a time when domestic manganese mining was at an ebb because war-time subsidies were not in place. The records are silent as to why E.F. Logan chose to begin his manganese enterprise at this time, but it may have been a means of making extra money during the Great Depression. Little capital is needed to operate a small manganese operation, and the federal government continued to stockpile the metal in limited quantities. Logan continued to at least intermittently work the mine during the 1930s, and in 1934, Logan's first ore shipment consisted of 71 tons of ore with 44% manganese and 2% silica (Wright and others 1953).

During World War II, Logan leased the mine to Suckow Borax Mines Consolidated Company of Los Angeles. In 1943, the Logan Mine produced about 300 tons of ore with 40% manganese that was shipped to the Metals Reserve Company. By the end of 1943, the California Division of Mines and Geology reported that the Logan Mine was idle, and no employees were working at the mine. Subsequent to the Suckow lease, the mine produced 200 tons of ore with 19% manganese and shipped it to the Kaiser Steel Corporation in Fontana. In 1953, the California Division of Mines and Geology reported that the mine continued to be worked occasionally (Tucker and Sampson 1943; Wright and others 1953).

The Logan Mine site (CA-SBR-4558H) measures approximately 4,048 feet SW/NE by 1,243 feet SE/NW with a total area of 75 acres (GIS calculation). The site has 12 mining cairns, 11 features, two historic refuse deposits, open pit mines, and dynamite blast quarry areas. The site is situated in and along the base of the Cady Mountains. Features occur along washes and lower desert pavement terraces, as well as on ridge tops. There are several road segments that have washed out throughout the site leading to areas of surface mining and structures within the site, all of which are in ruins. The site area is bounded to the north and northwest by the Cady Mountains and to the east, west, and south by open undeveloped BLM land. Sediment across the site is typically metavolcanic rocks, desert pavement, and fine grain alluvial sand with small to medium subrounded to sub-angular gravels and cobbles ranging from 1 to 30 centimeters in size.

Of the three manganese mines in the Project vicinity, the Logan Mine appears to have been the most active, but like the other two mines appears to have been a small operation with only a few employees at a time. Historical records do not describe the equipment used on site to extract and process the ore, but during the field investigation, structures that appear to be related to the concentration of manganese ore were documented. Most manganese mines in the vicinity relied only on hand sorting to concentrate the ore. Structures and pulverized ore at the Logan Mine indicate that the mine had a more elaborate concentration system. Features 6 through 9 probably are part of a small mill operation. Features 6 and 7 are remnants of a fallen wood and concrete structure that may have been part of a conveyor that delivered ore to Feature 8. Feature 8 has a concrete structure that may have served as a base for milling equipment. Nearby timber structures probably were chutes used to store ore. Feature 9 is a concrete-lined slurry pool measuring 20 feet wide and 16 feet deep that may have been used for some type of flotation process. Waste piles of pulverized rock surround these features. The mill and associated features probably date to the World War II years of operation when subsidized prices made investment in machinery feasible.

The concentration and processing area of the mine is located near the south end of the site. Feature 5, a collapsed wood-frame structure clad with corrugated metal with plastered interior walls, wood frame awning windows, and a porch, and Feature 11, a 52- by 55-inch privy, also are in this area. Debris found in the area includes lumber; tires; bed/couch springs; truck seat springs; brown glass; and oil, paint, and gas cans. The presence of these features and the associated debris indicates that this area may have been a habitation area for the mine workers. Debris noted within the concentration and processing area included a truck frame and parts, mason jars, sheet metal, siding, metal processing parts, oil filters, gas cans, rubber, wood/lumber, melted rubber, an oil can, and paint cans.

Features 2, 3, and 4 are located south of the concentration and processing area. Feature 2, a concrete pad with mounting bolts, and Feature 3, a wood utility pole, indicate that electricity was available on site. Feature 4 is east of Features 2 and 3 and is a 300-foot-deep well pipe or stand pipe.

Feature 10, the closest feature to the surface mine itself in the north end of the site, is a rock-lined foundation with posts in situ. Structural debris was located down a nearby drainage, and a historic refuse deposit was found northwest of the feature. Historic refuse included food and kerosene containers, glass, ceramics, construction materials, and a sole of a shoe. This trash indicates that this area also was used as a worker habitation area or was a dump site. A large quantity of household debris also was located down slope from the feature.

Feature 1, located southeast of Feature 10, consists of structural debris associated with a stand pipe. The debris appears to be fallen, non-residential, wood-framed mine structures with corrugated metal siding. At the center of the eastern site boundary, an L-shaped pipe was observed that extends upward 72 inches with 36 inches exposed and west 72 inches with 9 inches exposed, with the remainder subsurface. The pipe rests atop a pocket of eroded earth consistent with water flow down through the pipe. A rock foundation is located on the northern end of the site. The foundation is a rectangular and U-shaped, and is constructed with red metavolcanic rocks typical of the area.

The Logan Mine was evaluated within the context of manganese mining in the Project vicinity and in San Bernardino County. Like other mines in the area, the Logan Mine was active during times when manganese was in great demand and worked intermittently at other times. The Logan Mine was the largest producer of the three manganese mines in the Cady Mountain area, but was not a large producer in comparison with other mines in the Owlshead and Whipple mountains in San Bernardino County. Archaeological recording documented that there was some type of small-scale milling and concentrating operation at the Logan Mine. Historic documents indicated the processing or ore at most manganese mines in the region was limited to hand sorting, and had not reported the milling operation at the Logan Mine. Because the other two Cady Mountains manganese mining sites are not within the Project APE, they were not visited to determine if similar structures are present at those mines. Although there are a few standing features at the Logan Mine, it has been abandoned for some time and vandalism and neglect has affected the condition of the site. Historical records contain much information about manganese mining in California and San Bernardino County. The site recording of the Logan Mine and historic research that was conducted as part of this study has thoroughly documented the site and further research is unlikely to yield important information. Therefore, CA-SBR-4558 is not recommended eligible for the National Register and is not a historical resource pursuant to CEQA under any of the criteria for eligibility.

Historically, settlers have mined in and around the Mojave Desert since the late 19th century. Such sites are frequently demarcated by simple structures, rock cairns, and/or posts. The Cady Mountains have witnessed historical various mining activity. Research indicates that the Logan Mine, a manganese mine within the Project APE, was developed in the 1930s. Production apparently peaked in 1942 when 300 tons of ore were shipped to meet war time demands. The mine, however, was idle the following year and was only intermittently worked in the 1950s.

The results of the survey found that the Logan Mine (CA-SBR-4558H) has fallen into extreme disrepair. The ruins of this site consist of dilapidated structures associated with mining, including open pit mines, dynamite blast quarry areas, mining claim/cairns (one with the original mining claim), remnants of buildings and structures, and refuse associated with the occupation and operation of the mine. Overall, the condition of the site has been compromised over time, by looting, target practice, off-highway vehicular travel, and the elements. Historical records document much information about manganese mining in California and San Bernardino County. The recording of the Logan Mine site and historic research that was conducted as part of this study has thoroughly documented the site and further investigation has little potential to yield important information. The resource is recommended not eligible for the NRHP and CRHR. There are no other mines in the Project APE.

There are various mining claim cairns in and around the northern and eastern portion of the Cady Mountains, which extend into the Project APE. Along the abandoned segment of the National Old Trails Highway two cairns also were observed (P36-014519 and P36-014520). These rock concentrations are almost exactly 400 feet apart and both are approximately 250 feet from the centerline of the former alignment of the Old National Trails Highway. The placement of the cairns and absence of known mining deposits in the area indicates that these cairns probably are associated with the highway and may have been land surveying monuments. San Bernardino County was responsible for route planning at the time the Old National Trails Highway was designated, and the route may or may not have been professionally engineered. No historical "as built" drawings of the highway have been located, and thus, we cannot make a direct association between the rock cairns and the highway. Modern surface prospects also occur in the Project APE. They are shown on modern maps (1982 U.S.G.S. 7.5-minute topographic quadrangles), but are absent from historic maps (1955 U.S.G.S. 15-minute quadrangles). All of the surface prospects lack diagnostic material (documentation and/or datable cans/refuse) and are considered modern. There are numerous modern cairns marking OHV routes and camp sites that should not be confused with historic or prehistoric cairns.

C.3.4.14 POTENTIAL HISTORIC DISTRICTS

Southern California Edison Historic District

Resources that could be included in the potential SCE Historic District are the SCE 220kV North and South Transmission Lines (CA-SBR-13115H and CA-SBR-13116H), Pisgah Substation (CA-SBR-13117H), and archaeological site CA-SBR-12992H.

The SCE 220-kV North and South Transmission Lines are single-circuit transmission lines that originate at the SCE switchyard at Hoover Dam and terminate in Chino, California. Both transmission lines played significant roles in providing electricity that was essential to World War II industries located in southern California. The transmission lines were previously recorded in Nevada (site numbers 26CK6249 and 26CK6250) during the Boulder City/U.S. 93 Corridor Study, and the Federal Highway Administration and Nevada State Historic Preservation Office made a consensus determination that they are eligible for the NRHP. Both transmission lines are in service and are regularly maintained in the Project area, but they retain historical integrity. Because of the association of the transmission lines to Hoover Dam and their significance in the World War II effort, the SCE 220-Kilovolt North and South Lines were evaluated as eligible for the NRHP under Criterion A and the CRHR under Criterion 1.

The Pisgah Substation is an SCE switching station that was constructed in 1940 (personal communication, Thomas Taylor, Manager, Biological and Archaeological Resources, Southern California Edison, 18 September 2008). In addition to the equipment associated with the function of the substation, including switch gears and bus bars, the Pisgah Substation also has three buildings, which house the relay station and battery equipment. Because the Pisgah Substation is a component of the SCE 220-kV North and South Transmission Lines, the substation also was evaluated as eligible for the NRHP under Criterion A and for the CRHR under Criterion 1.

Archaeological site CA-SBR-12992H is a small, low-density scatter of historic trash with approximately 750 items, including glass fragments, animal bone fragments, tableware, ceramics, cans, wire, leather, and wood. The site has four concentrations of historic refuse. The site is near the SCE North and South Transmission Lines, and may be the remains of a work camp related to the construction of the transmission lines and the Pisgah Substation. The site was evaluated as not eligible for the NRHP and CRHR because of the low quantity of artifacts, lack of integrity, low probability of subsurface artifacts and features, and little potential for the site to yield important information.

The SCE 220-kV North and South Transmission Lines and Pisgah Substation are historically and functionally related and visually convey a historic theme in the Project vicinity. Both resources also possess historical significance and integrity and were recommended as individually eligible for the NRHP and CRHR. No artifacts were found that directly associate archaeological site CA-SBR-12992H to the SCE facilities, but its proximity to the transmission lines suggests it is related. However, the archaeological site was evaluated as not eligible and would not be a contributor to the potential historic district.

Both the National Park Service and State of California definitions indicate that historic districts must have definable and precise boundaries and that these boundaries rarely are defined by planning or management boundaries, or by ownership parcels, but rather must be based upon the spatial locations of the district's contributing properties (Title 14, California Code of Regulations, section 4852(a)(5); U.S. Department of the Interior, National Park Service 2002). The SCE 220-kV North and South Transmission Lines are long, linear resources that extend more than 200 miles between Hoover Dam in Nevada to Chino, California. Only about 4.7 miles of the transmission lines were recorded as part of this Project within the Pisgah Substation Triangle area and the historic built environment 0.5-mile buffer. Because the entire route of the transmission line was not studied as part of this Project, it is impossible to delineate a boundary that is not arbitrarily defined by the Project and buffer areas. Therefore, it seems inappropriate to define a district. Both transmission lines and the substation were recommended as individually eligible for listing in the NRHP and CRHR, and inclusion in a historic district would not upgrade their status for preservation purposes.

Atlantic & Pacific (Atchison, Topeka, & Santa Fe) Railroad Historic District

Resources that could be included in a potential Atlantic & Pacific (Atchison, Topeka, & Santa Fe) Railroad Historic District are the railroad (CA-SBR-6693H) and seven nearby refuse deposits. The Atlantic & Pacific Railroad was originally recorded as a historic resource in California in 1990. The Southern Pacific Railroad Company originally constructed the segment of the railroad in the Project vicinity as part of the Mojave to Needles branch in 1882 and 1883. In 1884, the Atlantic & Pacific Railroad, a subsidiary of the Santa Fe Pacific Railroad, leased the Mojave to Needles branch and purchased the single-track branch in 1911. In 1897, the branch was redesignated as the Santa Fe Pacific Railroad and later became known as the Atchison, Topeka, & Santa Fe Railway. In 1923, a second track was added. The railroad currently is used and maintained as the Burlington Northern Santa Fe Railway. In the Project area, the railroad has a double trackway on a raised, ballasted bed. The railroad has been previously evaluated as eligible for the NRHP and CRHR under Criterion A/1 for its association with the history of transportation in California. Although much of the railroad has been upgraded for continued use and few historical materials remain in place, the segment in the Project vicinity retains integrity of location. Thirteen previously unrecorded bridges were identified during the Class III intensive field survey along the railroad within the Project APE and the 1/2-mile built environment buffer. Five of the bridges retain sufficient integrity to be considered contributing elements to the railroad. The other eight are either modern replacement bridges or have been highly modified.

As of 2006, about 1,800 railroad-related properties had been listed in the NRHP. Most of these properties included depots, railroad cars, and locomotives. The only listed railways are shorter spur lines (Railway Preservation Resources 2006). Historic railroad districts that have been established in other locations typically include buildings and structures, such as homes, depots, warehouses, and commercial buildings, which were built as a result of the railroad and rarely include the railroad structure itself as a contributing property. Both the National Park Service and State of California definitions indicate that historic districts must have definable and precise boundaries and that these boundaries rarely are defined by planning or management boundaries (Title 14, California Code of Regulations, Chapter 11.5, Section 4852(a)(5); U.S. Department of the Interior, National Park Service 2002). The railroad is a long, linear resource that extends across seven states, and only about 10.5 miles of the railroad were recorded as part of this Project within the historic built environment 0.5-mile buffer. Because the entire route of the railroad was not studied as part of this Project, it is impossible to delineate a boundary for a segment of the railroad in the Project vicinity that would not be arbitrarily defined by the Project and buffer areas. Therefore, it seems inappropriate to define a district.

URS reviewed the site descriptions for the seven historic refuse sites located in the vicinity of the railroad, including CA-SBR-13002/H, -13012H, -13014H, -13017H, 13023/H, -13101, and -13108H. Because the sites have few temporally diagnostic artifacts, it is unclear whether these sites are contemporaneous. In addition, the types of artifacts do not indicate clear associations with the railroad. Three of these sites were evaluated as not eligible for the NRHP and CRHR because of the low quantity of artifacts, lack of integrity, low probability of subsurface artifacts and features, and little potential to yield important information. Four of these sites (CA-SBR-13002/H, -13012H, -13014H, -13017H) were recommended as eligible for the NRHP and CRHR for their potential to yield important information, and testing was recommended to provide the lead agency with additional data necessary to determine eligibility. The recommended limited subsurface testing at four of the historic refuse sites should be conducted to determine if additional information can be obtained to support the hypothesis that these sites are related to railroad activities or some other activity.

In summary, defining a railroad district seems inappropriate because any boundary on a segment of the railroad would be arbitrary, and the associations of the trash scatters have not been confirmed. The railroad in the Project area and the four trash scatters that have potential to yield important information were recommended eligible for listing in the NRHP and CRHR. Inclusion of those properties in a historic district would not upgrade their status for preservation purposes.

National Old Trails Highway/U.S. Route 66 Historic District

Resources that could be included in the potential National Old Trails Highway /U.S. Route 66 Historic District are extant segments of National Old Trails Highway, U.S. Route 66, and two rock concentrations. (The CEC and BLM identified a third rock concentration, P36-014578, in their data request, but it is located well to the north of the highways in the vicinity of the Logan Mine and almost certainly is unrelated to the highways).

U.S. Route 66 in the Solar 1 historic built environment 0.5 mile buffer area is a two-lane, paved roadway that currently serves as a frontage road for Interstate 40. This segment was originally constructed in the 1930s, south of the highway’s original alignment, which was known as the National Old Trails Road. The National Old Trails Road in the Project area is represented by eight remnant segments of a batched mix oil road. The condition of the road segments is poor — most of the road surface is crumbled and cracked, and in places has eroded. Some segments buried by sand may be partially intact.

The National Old Trails Road was designated by “booster” organizations in 1912, and by the late 1920s much of the highway was either oiled or surfaced with gravel. In 1926, the National Old Trails Highway was designated as U.S. Route 66, but in the 1930s the segment in the Project area was abandoned in favor of a route to the south, which is the current alignment of historical U.S. Route 66. Both the National Old Trails Road and 1930s alignment of U.S. Route 66 have been recorded under site number CA-SBR-2910H, and previously evaluated as eligible for the NRHP under Criterion A as one of the first all-weather highways in the United States.

The segment of U.S. Route 66 in the study area retains historical integrity and is considered eligible. The National Old Trails Road in the study area is physically distinct from the U.S. Route 66 (U.S. Route 66 is south of Interstate 40 and the National Old Trails Road is north of the Interstate. The National Old Trails Road preceded U.S. Route 66 chronologically and physically and has its own history and characteristics. The

National Old Trails Road is recommended as a distinct cultural resource that merits its own site number and independent determination of eligibility.

Two cairns also were recorded (P36-014519 and P36-014520) along the abandoned segment of the National Old Trails Highway. These rock concentrations are almost exactly 400 feet apart and both are approximately 250 feet from the centerline of the former alignment of the Old National Trails Highway. The placement of the cairns and absence of known mining deposits in the area suggests that these cairns may have been survey markers associated with the highway. San Bernardino County was responsible for route planning at the time the Old National Trails Road was designated, and the route may or may not have been professionally engineered. No historical as-built drawings of the highway have been located, and thus, a direct association between the rock cairns and the highway remains ambiguous. The cairns are recommended ineligible for the NRHP and not significant historical resources eligible for listing in the CRHR.

Segments of U.S. Route 66 and the National Old Trails Road have been listed in the NRHP in several states. U.S. Route 66 related districts have been listed but they include properties such as roadside businesses related to the development of the highway within the boundaries of a specific town or locality. There are no such properties in the Project vicinity, although a rest area associated with the National Old Trails Road may be present east of the CA-SBR-1908 site area at site RSS-017. A statewide inventory of U.S. Route 66 has not been conducted for California. If a historic district or multiple property listing of the highway was defined in California, the segment of the 1930s U.S. Route 66 in the Project vicinity probably would be considered a contributing element. However, defining a U.S. Route 66 district at the Project limits would be arbitrary for a highway that ran through Illinois, Missouri, Kansas, Oklahoma, Texas, New Mexico, Arizona, and California. Because the other associated properties have little historic value, there seems to be little justification for defining a National Old Trails Road/U.S. Route 66 Historic District.

Ethnographic Resources

There are no ethnographic resources that are presently known with certainty to be in sight of the proposed project area.

Preliminary Discussion on the Historical Significance of Ethnographic Resources. There are no ethnographic resources of historic significance in the proposed project.

C.3.4.15 ASSESSMENT OF IMPACTS AND DISCUSSION OF MITIGATION

Materials and Equipment Staging Area. A100-acre lay down yard will be cleared on the southeast corner of the project site where SunCatchers will be assembled. Assembly buildings will be constructed adjacent to the Main Services Complex for the onsite assembly of the SunCatchers. The assembly buildings will be decommissioned and salvaged for re-use once all Calico Solar SunCatchers have been installed. SunCatchers will be installed in the area vacated by the removal of the construction laydown areas and assembly buildings when construction is completed.

Operations Impacts

Liquid Wastes. SunCatcher mirror washing, operations dust control, potable water use, and water treatment under regular maintenance routines will require an average of 33.4 gallons of raw water per minute, with a daily maximum requirement of 56.6 gallons of raw water per minute during the summer peak months each year, when each SunCatcher receives a single mechanical wash. Road and SunCatcher area long-term maintenance would include:

- Temporary soil stabilization (SS) techniques, such as scheduling construction sequences to minimize land disturbance during the rainy and non-rainy seasons and employing BMPs appropriate for the season; preserving existing vegetation by marking areas of preservation with temporary orange propylene fencing; using geotextiles, mats, plastic covers, or erosion control blankets to stabilize disturbed areas and protect soils from erosion by wind or water; using earth dikes, drainage swales, or lined ditches to intercept, divert, and convey surface runoff to prevent erosion; using outlet protection devices and velocity dissipation devices at pipe outlets to prevent scour and erosion from storm water flows; and/or using slope drains to intercept and direct surface runoff or groundwater to a stabilized water course or retention area.
- Sediment Control (SC) techniques, such as using silt fences, straw bales, and/or fiber rolls to intercept and slow the flow of sediment-laden runoff such that sediment settles before runoff leaves the site.
- Wind Erosion (WE) control by applying water or dust palliatives, as required, to prevent or alleviate windblown dust.
- Tracking Control (TC) techniques to limit track-out, such as using stabilized points of entering and exiting the project site and stabilized construction roadways on the site.
- Other measures, as appropriate, to comply with the regulations.

Project Closure and Decommissioning

SES recognizes that development of a final termination and restoration strategy will be a collaborative process with the BLM and the CEC. Prior to authorization it is anticipated that more clarity related to this effort will be directed by the BLM. Following is a brief discussion of concepts that may be more fully considered in the development of a termination and restoration strategy for the project.

- Although the project setting for this project does not appear, at this time, to present any special or unusual closure problems, it is impossible to foresee what the situation will be in 30 years or more when the project ceases operation.
- To ensure adequate review of a planned project closure, the project owner would submit a proposed facility closure plan to the CEC and BLM for review and approval at least 12 months (or other period of time agreed to by the FAO) prior to commencement of closure activities.
- In order to ensure that public health and safety and the environment are protected in the event of an unplanned temporary facility closure, it is essential to have an on-site contingency plan in place. The on-site contingency plan will help to ensure that all necessary steps to mitigate public health and safety impacts and environmental

impacts are taken in a timely manner. The project owner would submit an on-site contingency plan for the FAO review and approval. The plan would be submitted no less than 60 days (or other time agreed to by the FAO) prior to commencement of commercial operation.

- In addition, consistent with requirements under unplanned permanent closure addressed below, the nature and extent of insurance coverage, and major equipment warranties must also be included in the on-site contingency plan. In addition, the status of the insurance coverage and major equipment warranties must be updated in the annual compliance reports.

SES continues to develop the design for the project, and will coordinate with all required agencies as part of the CEC/BLM permitting process. It is SES's understanding that a bond will be required for the SES Calico Solar Project.

Trenching for Buried Linear Facilities (Pipelines, Transmission Lines). SunCatcher systems will be tied together by an underground cable system.

Demolition of Structures on the Project Site or Along Linear Facilities. None.

Alterations to Old Substations or Transmission Lines to Upgrade for More Capacity. Final design and construction of transmission facilities and reliability upgrades at the SCE Pisgah Substation and the Pisgah-Lugo 230 kV Transmission Line (should they be required) will be completed by Southern California Edison.

Addition of New and Incompatible Structures in an Old Neighborhood (even an Industrial One), or in the Rural Setting of an Old Agricultural Landscape, or in an Old Transmission Line Corridor, Affecting the Integrity of Setting and Feeling. With the presence of gas pipelines, historic roads, railroad line, transmission lines, and a substation, the project area is currently an open and relatively undeveloped landscape.

<u>Identification and Assessment of Direct Impacts on Archaeological Resources and Recommended Mitigation</u>

A. Identification analysis is based on the three following observations:

1. Whereas testing has not been completed, a subset of sites may qualify for the NRHP and CRHR.
2. Given the low quantity and density of cultural resources present, it may be possible to avoid known cultural resources by project construction.
3. The potential exists for buried archaeological deposits.

B. The Project is anticipated to have the following effects/impacts:

1. Significant effect per NEPA.
2. Significant impact per CEQA.
3. Adverse effect per Section 106 of the NHPA.

The construction of the proposed Calico Solar thermal power facility may wholly or partially destroy the majority of the surface archaeological resources in the proposed project area and may wholly or partially destroy other buried archaeological deposits that may be components of project area landforms. The complete cultural resources inventory to date includes approximately 139 individual archaeological sites on the surface of the project area. Efforts are being made to avoid impacts/effects to archaeological resources. The surface sites include both stand-alone resources, groups of resources that fall into the archaeological site types described in the "Historical Significance and the Cultural Resources Inventory" subsection above, and resources that are contributing elements to the archaeological landscapes and districts that are also described in that subsection. Although staff is presently unable to identify precisely which of the different cultural resources are historically significant and is therefore presently unable to articulate the exact character of the effects that the construction of the proposed facility would have on such resources, staff does foresee that the construction of the proposed facility would, under both NEPA and CEQA, have a significant effect on the environment and would, under Section 106, have an adverse effect on historic properties. The proposed PA will set out procedures whereby staff, the State Historic Preservation Officer, the Advisory Council on Historic Preservation, the applicant, Native American groups, and other interested parties will identify programs and protocols that ensure that significant effects will be mitigated to a level that is not significant. Although the specific programs and protocols do not presently exist, it is possible to describe the performance standards that will be used to ensure that the resolution of significant effects to historically significant cultural resources is adequate, as well as the types of measures that can be used to resolve such effects.

As noted above, the analytical process involves five steps: 1) determination of the geographic extent of the project area of analysis; 2) creation of an inventory of the known resources within that area; 3) assessing the historical significance of those known resources; 4) assessing the effects of the project on significant historical resources; and 5) resolving significant effects on significant historical resources, and ensuring that all significant impacts/effects are mitigated. Energy Commission licensing decisions and BLM right-of-way grant decisions also typically identify the likelihood of encountering previously unknown resources and contain provisions that require specific procedures that ensure that any effects to these resources can be resolved. Due to the fact that the high number of cultural resources for this project renders the evaluation of all known resources infeasible, staff is recommending that that type of approach be extended to those known resources that it is infeasible to evaluate prior to agency decisions.

The PA provides a valuable vehicle for this approach. As noted above, the first step of the analytical process is complete. To complete the second step and acquire the data necessary to complete the third step, the PA will require that the project owner conduct fieldwork to collect the balance of the requisite primary data on the cultural resources in the project area of analysis with which to evaluate their historical significance. This fieldwork will consist of, as appropriate, the collection of further surface and subsurface data on each resource sufficient to develop formal recommendations of historical significance. The fieldwork will consist of a sequence of surface and subsurface phases of investigation. Criteria set out in the PA will guide decisions on the number and extent of the phases needed to investigate each subject cultural resource. The conclusion of the third step will be accomplished by applying the thresholds of resource integrity identified above in section C.3.3.3 for newly-discovered resources. Similarly, the fourth step will involve identification of any of the types of effects identified in Section C.3.3.4 above to significant historical resources. The fifth and final step — implementing treatment measures that meet standards for the resolution of significant effects on significant historical resources and historic properties under CEQA, NEPA, and Section 106 — will occur through the joint efforts of the Energy Commission and BLM, and will be reflected in the PA. Common types of measures can include avoidance (requiring that physical structures be located only in certain areas), monitoring by cultural resources specialists and Native American monitors, recordation, recovery, and curation.

The methods that the PA will employ to resolve potentially significant effects to significant cultural resources will vary relative to the values for which the resources are found to be significant. For example, cultural resources that are found to be significant on the basis of their information value, principally archaeological deposits, will be subject to suites of treatments the purposes of which will variably be to actively avoid all or part of subject deposits, to record and preserve representative samples of the unique spatial or associative information that is intrinsic to the depositional history of each deposit, to collect and curate representative samples of material culture assemblages, to provide for the preparation and dissemination of professional technical publications and public interpretative materials, and to develop and implement plans to foster the long-term historic preservation of subject deposits. Archaeological resources in the project area of analysis that may be subject to unique treatment plans may include archaeological landscapes and districts and archaeological site types in addition to individual archaeological sites.

The resolution of potentially significant effects on cultural resources that derive historical significance from values other than information potential is not as straightforward. Mitigation options for cultural resources that are significant for different associative values such as association with important events or patterns in prehistory or history, with important persons, or with distinctive construction and design techniques may range widely. As the Section 106 consultation process is currently involved in developing mitigation options for a number of different cultural resources with broader associative values, staff does not wish to inadvertently preempt the outcomes of that process by laying out what would essentially be guesses about the direction that particular mitigation measures may go.

Behavioral interpretation and determinations on the historical significance of the deposits would be made under provisions in the proposed PA and would rely on the interpretations ultimately derived for them. The further inventory of potential contributing elements to the proposed cultural landscapes, refinements to the recordation of those elements, and determinations on the historical significance of the landscape as a whole and of the individual contributing elements, both as contributing elements and as stand-alone archaeological resources would be made under provisions in the proposed PA. The PA would stipulate treatment measures based on consultation with consulting parties.

If NRHP and/or CRHR-listed or eligible properties will be adversely affected by the project, a cultural resources treatment plan will be developed in consultation with the consulting parties to the PA. This plan would stipulate specific measures that will be implemented during final design, prior to and during construction, and during project operations. Treatment measures may include but are not limited to the following:

- Avoidance of resources wherever possible, including establishment of environmentally sensitive areas to be off-limits to construction;
- Make good faith effort to take into account comments and input from interested parties;
- If resources cannot be avoided, devise strategies to minimize impacts, including construction monitoring;
- Conducting data recovery excavations for significant resources that cannot be avoided; and
- Recovery and repatriation of human remains per the Native American Graves Protection and Repatriation Act (NAGPRA).

Archaeological resources that are found to be significant on the basis of values other than or in addition to their information value will be subject to treatment measures that more appropriately reflect the character of those other values.

Staff has been involved in the implementation of contingency plans adopted in past siting cases, as well as in the implementation of PAs and finds that if they include the types of specific standards identified above, they can be effective in identifying and evaluating cultural resources and mitigating potential impacts to those resources. Staff anticipates that the PA will be complete prior to the decision on this application. Even without a final PA, staff is confident that a condition of certification that requires the process and standards identified above will ensure that all significant effects to cultural resources can be resolved or mitigated to a level that is less than significant.

Identification and Assessment of Direct Impacts on Ethnographic Resources and Recommended Mitigation

No NRHP- or CRHR-eligible ethnographic resources are presently known to be in the project area of analysis. Further refinements to determinations of the historical significance and to the extant assessments of the potential for visual effects to occur to other ethnographic resources known to be in the vicinity of the project area would help evaluate whether construction-related ground disturbance of the project would directly impact ethnographic resources that would qualify as historically significant cultural resources.

Identification and Assessment of Direct Impacts on Built-environment Resources and Recommended Mitigation

Whereas determinations regarding NRHP- or CRHR-eligibility of built-environment resources within the project area of analysis have not been completed, identification and assessment of impacts cannot be assessed at this time. Given the relatively complete investigation of that area and the dearth of historically significant built-environment resources found, it appears to be unlikely that the construction-related ground disturbance of the project area would directly impact built-environment resources that would qualify as historical resources under CEQA.

Identification and Assessment of Indirect Impacts and Recommended Mitigation

There is potential for indirect effects to sites in the exclusion area especially due to increased traffic during construction and/or visual effects as described above for cremation sites. It is also possible that project area grading could increase the amount of sheet washing and water runoff during heavy rainfall and indirectly cause damage to sites outside the project area. Consideration of a monitoring plan for those sites would be the foundation for mitigation, and additional measures could be developed through the PA consultation process.

Operation Impacts

Many impacts described above as part of construction also apply to the operation phase. During operation of the proposed power plant, repair of a buried utility or other buried infrastructure could require the excavation of a large hole. Such repairs have the potential to impact previously unknown subsurface archaeological resources in areas unaffected by any original trench excavation. The measures proposed under **CUL-1** for mitigating impacts to previously unknown archaeological resources during the construction of the plant and linear facilities would also serve to mitigate impacts from repairs occurring during operation of the plant.

Project Closure and Decommissioning

Re-excavation and removal of SunCatchers™ and ancillary facilities could impact cultural resources. Resolution of effects to resources will be determined in consultation with all the consulting parties and incorporated into the Programmatic Agreement.

C.3.5 REDUCED ACREAGE ALTERNATIVE

The Reduced Acreage Alternative would be a 275 MW solar facility located within the boundaries of the proposed project as defined by SES. This alternative is analyzed because (1) it eliminates about 67% of the proposed project area so all impacts are reduced, especially those related to desert washes, biological resources, and cultural resources, and (2) it could transmit the power generated without requiring an upgrade to 65 miles of the existing 220 kV SCE Pisgah-Lugo transmission line.

The Reduced Acreage Alternative would consist of 11,000 SunCatchers with a net generating capacity of approximately 275 MW occupying approximately 2,600 acres of land. This alternative would retain 31% of the proposed SunCatchers and would affect 33% of the land of the proposed 850 MW project.

The boundaries of the Reduced Acreage Alternative are shown in **Alternatives Figure 1**. This area was designed to avoid sensitive cultural resources and areas that were mapped as occupied tortoise habitat (live tortoise and/or active burrows and sign).

Similar to the proposed project, the Reduced Acreage Alternative would transmit power to the grid through the SCE Pisgah Substation and would require infrastructure including water storage tanks, transmission line, road access, main services complex, and substation (SES 2008a). However, as stated above, the Reduced Acreage alternative would not require the 65-mile upgrade to the SCE transmission line. SCE would complete system upgrades within existing substation boundaries to accommodate the 275 MW, and the 220 kV transmission line would be used. The main services complex, primary water well, and substation and onsite transmission line for the Reduced Acreage Alternative would remain at the location proposed for the proposed project.

As stated above, the Reduced Acreage Alternative is evaluated in this SA/DEIS because it would substantially reduce the impacts of the project. Additionally, the Reduced Acreage Alternative would allow the applicant to demonstrate the success of the Stirling engine technology and construction techniques, while minimizing impacts to the desert environment. Such a limited or phased alternative was suggested in numerous scoping comments.

C.3.5.1 SETTING AND EXISTING CONDITIONS

Please refer to subsection C.3.4.1 in discussion of the proposed action. Whereas the setting and existing conditions of the Reduced Acreage alternative are the same as Phase 1 of the proposed project, the Reduced Acreage alternative would occupy only 31% of the proposed project area. The specific locations of SunCatchers for the Reduced Acreage alternative would avoid sensitive cultural and biological resources, as well as desert washes as part of the construction of a 275 MW solar facility within the proposed project area.

Regional Setting

The regional setting of the Reduced Acreage alternative is the same as Phase 1 of the proposed project. Please refer to subsection C.3.4.1 in discussion of the proposed action.

Environmental Setting

Please refer to “Environmental Setting” subsection C.3.4.1 for proposed action.

Cultural Setting

Please refer to “Cultural Setting” subsection C.3.4.1 for proposed action.

Cultural Resources Inventory

A records search was performed by URS. Please refer to the Cultural Resources Inventory for the proposed action. Seventeen (15) sites have been identified as part of the 25% re-survey and recorded in the project area of analysis for the alternative and are presented in Cultural Resources Table 9 below.

Cultural Resources Table 9
Cultural Resources Site in Reduced Acreage Alternative (25% Sample)

Site No.	Site Type	Cultural Context	Potential for Buried Deposits Based on Geomorphologic Information	Project Area Location
SGB-013 CA-SBR-13096	Lithic scatter	Prehistoric	Low	North Alluvial Fan
DRK-150 CA-SBR-13009	Lithic Scatter	Prehistoric	Moderate	South Inset fan
DRK-155H CA-SBR-13012H	Trash Scatter	Historic	Moderate	South Alluvial fan
DRK-166 CA-SBR-13015	Lithic Scatter/ Lithic Reduction	Prehistoric	Low	South Pisgah lava
DRK-170 CA-SBR-13018	Lithic Scatter/Lithic Reduction	Prehistoric	Low	South Pisgah lava
DRK-171 CA-SBR-13019	Lithic Scatter	Prehistoric	Low	South Pisgah lava
DRK-176/H CA-SBR-13023H	Lithic Scatter Trash Scatter	Prehistoric Historic	Moderate	South Axial channel
RAN-114 CA-SBR-13059	Lithic Scatter/Lithic Reduction	Prehistoric	Low	South Pisgah lava
RAN-163 CA-SBR-13071	Lithic Scatter/Lithic Reduction	Prehistoric	Very low	South
RAN-169 CA-SBR-13073	Lithic Scatter	Prehistoric	Moderate	South Alluvial fan
RAN-177 CA-SBR-13078	Lithic Scatter	Prehistoric	Moderate	South
SGB-112/H CA-SBR-13108H	Lithic Scatter/Lithic Reduction Historic Trash	Prehistoric Historic	Moderate	South Pisgah lava
SGB-114 CA-SBR-13109	Lithic Scatter	Prehistoric	Low	South Pisgah lava
SGB-118 CA-SBR-13110	Lithic Scatter	Prehistoric	Very low	South Pisgah lava
SGB-127 CA-SBR-13112	Lithic Scatter	Prehistoric	Low	South Pisgah lava

RAN-114, DRK170-171, DRK-166, SGB112H and the rest of the Pisgah Complex that is west of the Pisgah Crater Road appear to be only partially within the southern boundary line for the reduced acreage alternative

C.3.5.2 ASSESSMENT OF IMPACTS AND DISCUSSION OF MITIGATION

A. Identification analysis is based on the three following observations:

1. Whereas testing has not been completed, a subset of sites may qualify for the NRHP and CRHR.
2. Given the low quantity and density of cultural resources present, it may be possible to avoid known cultural resources by project construction.
3. The potential exists for buried archaeological deposits.

B. The alternative is anticipated to have the following effects/impacts:

1. Significant effect per NEPA.
2. Significant impact per CEQA.
3. Adverse effect per Section 106 of the NHPA.

When resource evaluations have been completed, impacts will be assessed. The observation and identification of 15 cultural resources thus far as part of the 25% re-survey suggests periodic use of the project landform in the past. Severity and extent of impacts would be reduced given the presence of fewer cultural resources within this alternative that is 31% the size of the proposed project. If impacts are deemed significant, mitigation measures would be stipulated and refined in a Programmatic Agreement negotiated among all consulting parties and executed by the BLM, as described above for the proposed Project.

C.3.5.3 CEQA LEVEL OF SIGNIFICANCE

The Reduced Acreage alternative would result in a reduction of impacts to cultural resources. It is presumed that this alternative could also result in significant impacts under CEQA. The implementation of a Programmatic Agreement is anticipated to reduce the severity of impacts to cultural resources to a level below significance under CEQA. Therefore, it is anticipated that this alternative would result in impacts that would be less than those of the proposed Project.

C.3.5.4 CUMULATIVE IMPACTS

This alternative would result in the conversion of 2,600 acres of undeveloped open space with an industrial utility use. When compared to the proposed action, this alternative would result in approximately 69% less land conversion to industrial uses. However, the cumulative effects of this amount of land conversion along with all other existing, planned, and proposed projects would result in adverse cumulative land conversion.

C.3.6 AVOIDANCE OF DONATED AND ACQUIRED LANDS ALTERNATIVE

The Avoidance of Donated and Acquired Lands Alternative would be an approximately 720 MW solar facility located within the boundaries of the proposed project. This alternative is analyzed because (1) it eliminates about 15% of the proposed project area so all impacts are reduced, and (2) it would not require use of any lands that were donated to BLM or acquired by BLM through the Land and Water Conservation Fund program. This alternative would be consistent with the May 27, 2009 BLM Interim Policy Memorandum (CA-2009-020) on donated and acquired lands. The Interim Policy Memorandum (CA-2009-020) states the following.

- *Lands acquired by BLM under donation agreements, acquired for mitigation/ compensation purposes and with LWCF funds, are to be managed as avoidance/exclusion areas for land use authorizations that could result in surface disturbing activities.*
- *Should BLM –California managers have use authorizations applications pending, or receive new applications on lands that meet the above criteria, they are required to notify the State Director and set up a briefing to address how to respond to those applications.*
- *Should managers have inquiries related to pre-application activities for any land use authorizations on lands that meet the above criteria, please notify applicants regarding the location of these lands as soon as possible and advise them to avoid these lands or provide details on how they would plan to operate or mitigate their project in a manner consistent with the values of the lands donated or acquired for conservation purposes.*

The Avoidance of Donated and Acquired Lands Alternative would contain approximately 28,800 SunCatchers with a net generating capacity of approximately 720 MW occupying approximately 7,050 acres of land. This alternative would retain 85% of the proposed SunCatchers and would affect 85% of the land of the proposed 850 MW project.

The boundaries of the Avoidance of Donated and Acquired Lands Alternative are shown in **Alternatives Figure 2**. The easternmost parcel of the alternative is bordered by LWCF acquired lands to the north, south, and west. Because this parcel could not be reached via project lands, access to this section would be limited to use of the existing transmission line access road that forms the eastern boundary of the parcel, therefore avoiding any new direct impacts to LWCF lands.

The Avoidance of Donated and Acquired Lands Alternative would transmit power to the grid through the SCE Pisgah Substation and would require infrastructure including water storage tanks, transmission line, road access, main services complex, and substation. Because the Avoidance of Donated and Acquired Lands Alternative would generate approximately 720 MW of power, it would require a 65-mile upgrade to the SCE Pisgah-Lugo transmission line. Note that the impacts of this transmission line upgrade are analyzed in Sections C and D of this SA/EIS. The main services complex, primary water well, and substation, and transmission line for the Reduced Acreage Alternative would be at the same locations as for the proposed project.

C.3.6.1 SETTING AND EXISTING CONDITIONS

This alternative would exclude donated and acquired lands located throughout the proposed project site, which would decrease the amount of land converted to an industrial use. Nonetheless, as this alternative would have the same outer project boundaries as the proposed action, the environmental setting would be the same as the proposed action.

Environmental Setting

Please refer to “Environmental Setting” subsection for proposed action.

Cultural Setting

Please refer to “Cultural Setting” subsection for proposed action.

Cultural Resources Inventory

A records search was performed by URS. Please refer to the Cultural Resources Inventory for the proposed action. Forty-four (44) sites have been identified as part of the 25% re-survey and recorded in the project area of analysis for the alternative and are presented in Table 10. Site descriptions are provided in Table 6.

Cultural Resources Table 10
Cultural Resources in Project Area of Analysis
for Avoidance of Donated and Acquired Lands Alternative (25% Sample)

Site No.	Site Type	Cultural Context	Potential for Buried Deposits Based on Geomorphologic Information	Project Area Location
KRM-003 CA-SBR-13029	Lithic Scatter	Prehistoric	Low	North Alluvial fan
KRM-028 CA-SBR-13032	Trail	Prehistoric	Very Low	North Alluvial fan
RAN-011 CA-SBR-13053	Lithic Scatter	Prehistoric	Moderate	North Alluvial fan
RAN-025 CA-SBR-13054	Lithic Scatter	Prehistoric	Very Low	North Alluvial fan
SGB-013 CA-SBR-13096	Lithic Scatter	Prehistoric	Low	North Alluvial fan
CA-SBR-6512/ CA-SBR-6513 (SGB-028)	Lithic Scatter/ Lithic Reduction/ Stone Mounds	Prehistoric	Low	South Inset fan
DRK-133 CA-SBR-13001	Lithic Scatter	Prehistoric	Low	South
DRK-140 CA-SBR-13005	Lithic Scatter	Prehistoric	Moderate	South Inset fan
DRK-150 CA-SBR-13009	Lithic Scatter	Prehistoric	Moderate	South Inset fan
DRK-155H CA-SBR-13012H	Trash Scatter	Historic	Moderate	South Alluvial fan
DRK-166 CA-SBR-13015	Lithic Scatter/ Lithic Reduction	Prehistoric	Low	South Pisgah lava

DRK-170 CA-SBR-13018	Lithic Scatter/ Lithic Reduction	Prehistoric	Low	South Pisgah lava
DRK-171 CA-SBR-13019	Lithic Scatter	Prehistoric	Low	South Pisgah lava
DRK-176/H CA-SBR-13023/H	Lithic Scatter Trash Scatter	Prehistoric Historic	Moderate	South Axial channel
DRK-182 CA-SBR-13026	Lithic Scatter/ Lithic Reduction	Prehistoric	Low	South
KRM-131	Lithic Scatter	Prehistoric	Very Low	Inset fan/Relict alluvial fan South
KRM-133	Lithic Scatter	Prehistoric	Very Low	Inset fan/Relict alluvial fan South
KRM-135 CA-SBR-13033	Lithic Scatter/ Lithic Reduction	Prehistoric	Very Low	Inset fan/Relict alluvial fan South
KRM-137 CA-SBR-13034	Lithic Scatter	Prehistoric	Very Low	Inset fan/Relict alluvial fan South
KRM-141 CA-SBR-13035	Lithic Scatter	Prehistoric	Low	South Inset fan/ Relict alluvial fan
KRM-153 CA-SBR-13036	Lithic Scatter	Prehistoric	Very Low	South Inset fan/ Relict alluvial fan
KRM-154	Lithic Scatter	Prehistoric	Very Low	South Inset fan/ Relict alluvial fan
KRM-170 CA-SBR-13041	Lithic Scatter/ Lithic Reduction/ Rock Feature	Prehistoric	Moderate	South Inset fan
LTL-009 CA-SBR-13043	Lithic Scatter/ Lithic Reduction	Prehistoric	Low	South Pisgah lava
RAN-107 CA-SBR-13057	Lithic Scatter	Prehistoric	Moderate	South Inset fan
RAN-110 CA-SBR-13058	Lithic Scatter	Prehistoric	Low	South Inset fan
RAN-114 CA-SBR-13059	Lithic Scatter/ Lithic Reduction	Prehistoric	Low	South Pisgah lava
RAN-154 CA-SBR-13069	Lithic Scatter	Prehistoric	Very Low	South Inset fan
RAN-155 CA-SBR-13070	Lithic Scatter/ Lithic Reduction	Prehistoric	Low	South Pisgah lava
RAN-163 CA-SBR-13071	Lithic Scatter/ Lithic Reduction	Prehistoric	Very Low	South
RAN-169 CA-SBR-13073	Lithic Scatter	Prehistoric	Moderate	South Alluvial fan
RAN-175 CA-SBR-13077	Lithic Scatter	Prehistoric	Low	South
RAN-177 CA-SBR-13078	Lithic Scatter	Prehistoric	Moderate	South

RAN-183 CA-SBR-13082	Lithic Scatter/ Lithic Reduction	Prehistoric	Very Low	South Pisgah lava
RSS-006 CA-SBR-13087	Lithic Scatter	Prehistoric	Low	South Pisgah lava
RSS-008 CA-SBR-13088	Lithic Scatter/ Lithic Reduction	Prehistoric	Low	South Pisgah lava
RSS-011 CA-SBR-13090	Lithic Scatter/ Lithic Reduction	Prehistoric	Low	South Pisgah lava
SGB-112/H CA-SBR-13108/H	Lithic Scatter/ Lithic Reduction Historic Trash	Prehistoric Historic	Moderate	South Pisgah lava
SGB-114 CA-SBR-13109	Lithic Scatter	Prehistoric	Low	South Pisgah lava
SGB-118 CA-SBR-13110	Lithic Scatter	Prehistoric	Very Low	South Pisgah lava
SGB-127 CA-SBR-13112	Lithic Scatter	Prehistoric	Low	South Pisgah lava
KRM-131 CA-SBR-13120	Lithic Scatter/ Lithic Reduction	Prehistoric	Very Low	South Inset fan
KRM-133 CA-SBR-13121	Lithic Scatter/ Lithic Reduction	Prehistoric	Low	South Inset fan
EJK-005 CA-SBR-13125	Lithic Scatter	Prehistoric	Low	South Relict alluvial fan

C.3.6.2 ASSESSMENT OF IMPACTS AND DISCUSSION OF MITIGATION

A. Identification analysis is based on the three following observations:

1. Whereas testing has not been completed, a subset of sites will qualify for the NRHP and CRHR.
2. Given the high quantity and density of cultural resources present, cultural resources cannot be completely avoided by project construction.
3. The potential exists for buried archaeological deposits.

B. The alternative is anticipated to have the following effects/impacts:

1. Significant effect per NEPA.
2. Significant impact per CEQA.
3. Adverse effect per Section 106 of the NHPA.

A PA would be drafted and negotiated among all consulting parties, including interested Tribes. The agreement would stipulate the development of treatment plans, including the refinement and definition of mitigation measures.

C.3.6.3 CEQA LEVEL OF SIGNIFICANCE

The Avoidance of Acquired and Donated Land alternative would result in a reduction of impacts to cultural resources. It is presumed that this alternative could also result in significant impacts under CEQA. The implementation of a Programmatic Agreement is anticipated to reduce the severity of impacts to cultural resources to a level below significance under CEQA. Therefore, it is anticipated that this alternative would result in impacts that would be less than those of the proposed Project.

C.3.6.3 CUMULATIVE IMPACTS

This alternative would result in the conversion of 7,050 acres of undeveloped open space with an industrial utility use. When compared to the proposed action, this alternative would result in approximately 15% less land conversion to industrial uses. However, the cumulative effects of this amount of land conversion along with all other existing, planned, and proposed projects would result in adverse cumulative land conversion.

C.3.7 NO ACTION ALTERNATIVE

There are three No Project/No Action Alternatives evaluated in this section, as follows:

C.3.7.1 NO PROJECT/NO ACTION ALTERNATIVE #1:

No Action on the Calico Solar Project Application and on CDCA Land Use Plan Amendment

In the No Project / No Action Alternative, the proposed action would not be undertaken. The BLM land on which the project is proposed would continue to be managed within BLM's framework of a program of multiple use and sustained yield, and the maintenance of environmental quality [43 U.S.C. 1781 (b)] in conformance with applicable statutes, regulations, policy and land use plan.

The results of the No Project / No Action Alternative would be the following:

- The impacts of the proposed project would not occur.
- The land on which the project is proposed may or may not become available to other uses (including another solar project), depending on BLM's actions with respect to the amendment of the California Desert Conservation Area Plan.
- The benefits of the proposed project in reducing greenhouse gas emissions from gas-fired generation would not occur. Both State and Federal law support the increased use of renewable power generation.

Under this alternative, the proposed Calico Solar Project would not be approved by the Energy Commission and BLM and BLM would not amend the CDCA Plan. As a result, no solar energy project would be constructed on the project site and BLM would continue to manage the site consistent with the existing land use designation in the CDCA Land Use Plan of 1980, as amended.

Because there would be no amendment to the CDCA Plan and no solar project approved for the site under this alternative, it is expected that the site would continue to remain in its existing condition, with no new structures or facilities constructed or operated on the site and no new ground disturbance. As a result, no loss or degradations to cultural resources from construction or operation of the proposed project would occur. However, the land on which the project is proposed would become available to other uses that are consistent with BLM's land use plan, including another solar project requiring a land use plan amendment. In addition, in the absence of this project, other renewable energy projects may be constructed to meet State and Federal mandates, and those projects would have similar impacts in other locations.

If this project is not approved, renewable projects would likely be developed on other sites in the California Desert or in adjacent states as developers strive to provide renewable power that complies with utility requirements and State/Federal mandates. For example, there are large solar and wind projects proposed on BLM land along the Interstate 40 corridor within a few miles of the Calico Solar Project site. In addition, there are currently over 70 applications for solar projects covering over 650,000 acres pending with BLM in California.

C.3.7.2 NO PROJECT/NO ACTION ALTERNATIVE #2:

No Action on Calico Solar Project and Amend the CDCA Land Use Plan to Make the Area Available for Future Solar Development

Under this alternative, the proposed Calico Solar Project would not be approved by the Energy Commission and BLM and BLM would amend the CDCA Land Use Plan of 1980, as amended, to allow for other solar projects on the site. As a result, it is possible that another solar energy project could be constructed on the project site.

Because the CDCA Plan would be amended, it is possible that the site would be developed with a different solar technology. As a result, ground disturbance would result from the construction and operation of the facility providing different solar technology and would likely result in a loss or degradation to cultural resources. Different solar technologies require different amounts of grading and maintenance; however, it is expected that all solar technologies require some grading and ground disturbance. As such, this No Project/No Action Alternative could result in impacts to cultural resources similar to the impacts under the proposed project.

C.3.7.3 NO PROJECT/NO ACTION ALTERNATIVE #3:

No Action on the Calico Solar Project Application and Amend the CDCA Land Use Plan to Make the Area Unavailable for Future Solar Development

Under this alternative, the proposed the Calico Solar Project would not be approved by the Energy Commission and BLM and the BLM would amend the CDCA Plan to make the proposed site unavailable for future solar development. As a result, no solar energy project would be constructed on the project site and BLM would continue to manage the site consistent with the existing land use designation in the CDCA Land Use Plan of 1980, as amended.

Because the CDCA Plan would be amended to make the area unavailable for future solar development, it is expected that the site would continue to remain in its existing condition, with no new structures or facilities constructed or operated on the site and no corresponding land disturbance. As a result, the cultural resources of the site are not expected to change noticeably from existing conditions and, as such, this No Project/No Action Alternative would not result in impacts to cultural resources. However, in the absence of this project, other renewable energy projects may be constructed to meet State and Federal mandates, and those projects would have similar impacts in other locations.

C.3.8 PROJECT-RELATED FUTURE ACTIONS - CULTURAL RESOURCES AND NATIVE AMERICAN VALUES

This section examines the potential impacts of future transmission line construction, line removal, substation expansion, and other upgrades that may be required by Southern California Edison Company (SCE) as a result of the Calico Solar Project. The SCE upgrades are a reasonably foreseeable event if the Calico Solar Project is approved and constructed as proposed.

The SCE project will be fully evaluated in a future EIR/EIS prepared by the BLM and the California Public Utilities Commission. Because no application has yet been submitted and the SCE project is still in the planning stages, the level of impact analysis presented is based on available information. The purpose of this analysis is to inform the Energy Commission and BLM, interested parties, and the general public of the potential environmental and public health effects that may result from other actions related to the SES Calico Solar project, and to identify mitigation measures that could lessen such impacts that a level that is not significant.

The project components and construction activities associated with these future actions are described in detail in Section B.3 of this Staff Assessment/EIS. This analysis examines the construction and operational impacts of two upgrade scenarios

- The **275 MW Early Interconnection Option** would include upgrades to the existing SCE system that would result in 275 MW of additional latent system capacity. Under the 275 MW Early Interconnection option, Pisgah Substation would be expanded adjacent to the existing substation, one to two new 220 kV structures would be constructed to support the gen-tie from the Calico Solar Project into Pisgah Substation, and new telecommunication facilities would be installed within existing SCE ROWs.
- The **850 MW Full Build-Out Option** would include replacement of a 67-mile 220 kV SCE transmission line with a new 500 kV line, expansion of the Pisgah Substation at a new location and other telecommunication upgrades to allow for additional transmission system capacity to support the operation of the full Calico Solar Project.

C.3.8.1 ENVIRONMENTAL SETTING

The environmental setting described herein incorporates both the 275 MW Early Interconnection and the 850 MW Full Build-Out options. The setting for the 275 MW

Early Interconnection upgrades at the Pisgah Substation and along the telecomm corridors is included within the larger setting for the project area under the 850 MW Full Build-Out option.

Cultural Resources Overview. The Lugo-Pisgah project area is located in the western Mojave Desert where numerous large-scale inventory projects have been conducted. In part, these projects have defined a cultural chronology for the area that spans the last 12,000 years (SES 2008a). Ethnographically, the project area is centered on the traditional lands of the Serrano, a Numic speaking group related to the Shoshone. Between these earliest and latest Native American periods is a rich cultural history. The Mojave Desert is suggested to have been the area of principal point of origin for the migration of the Numic language group, which spread northeastward into the Great Basin and eventually the northern Colorado Plateau. Many of the distinctive projectile point types described for the Great Basin and Southwest culture areas may have originated in the broad geographic area of the Mojave Desert.

Native American history begins with the Clovis culture, the earliest substantively established cultural period in the Western Hemisphere and the only “classic” Paleoindian period represented in the project area. Dated from 10,000 to 8,000 B.C., the Clovis period is represented by distinctive spear points with a central flute or groove on either side of the point. These points are extremely well made and have been found in association with extinct Pleistocene megafauna. Because of the emphasis Clovis people placed on their hunting technology, researchers have tended to interpret Clovis as geared specifically towards big game hunting. In recent years this assumption has been challenged with increasing evidence towards a broader spectrum subsistence strategy (SES 2008a).

The transition from the Pleistocene to the Holocene is marked by significant environmental changes that resulted in equally significant changes in human settlement and subsistence strategies. The Lake Mojave Complex follows Clovis and subsumes several other named complexes, including the Western Pluvial Lakes Tradition and the San Dieguito Complex, among others. Again, the Mojave Complex is represented by a distinct projectile point that tapers to a rounded base. Dates of the complex are ca. 8000 to 6000 B.C. The period is associated with relatively wet conditions and periodic lake recharge in the region. Material culture for the period is dominated by a stone tool technology geared towards a forager-like subsistence strategy. Such a strategy reflects the frequently changing environmental conditions and patchy resources that would be available necessitating frequent settlement shifts.

Changing environmental conditions to more arid, present-day conditions, marks the transition to the Middle Holocene and the Pinto Complex, which overlaps slightly with the preceding Lake Mojave Complex, and persists to about 3000 B.C. There is broad similarity with the Lake Mojave Complex, especially in toolstone selection and overall technology; however, the Pinto Complex begins the first extensive use of milling tools presumed to reflect the intensification of vegetal processing. An emphasis towards plant resources probably reflects a more predictable biotic environment. The range of settlements across the landscape also suggests more predictable subsistence resources and characterizes the complex overall as spatially extensive.

A new complex has been recently defined based on archaeological work within the Twentynine Palms area (SES 2008a). Although acknowledged as spatially confined for the time being, future work will undoubtedly extend the range of the Deadman Lake Complex. The associated assemblage is described with contracting stemmed or lozenge-shaped projectile points, battered cobbles and core tools, biface technology, and milling stones. Preliminary dating places the complex from 7500 to 5200 B.C. An occupation hiatus is suggested for the period between 3000 and 2000 B.C. Population density was very low (based on known archaeological sites) and large-scale abandonment is presumed for the Mojave Desert. After 2000 B.C. is the Gypsum Complex, represented by well-known projectile point styles, including the contracting stemmed Gypsum, Elko series, and Humboldt series projectile point types. Few excavated components are known from the project area despite the wide settlement pattern represented by these distinctive projectile point styles.

Following the Gypsum Complex, by A.D. 200 the Rose Springs Complex marks the introduction of the bow and arrow technology and significant population increase (SES 2008a). Rose Spring projectile points are smaller and were presumably hafted as arrow points. Environmental conditions were wetter and cooler during this period allowing Rose Spring settlement patterns to shift back to the Mojave Desert. Material culture is diverse and extensive and is often found as well developed middens. Architecture is first recognized during this period including wickiups and pit houses. Obsidian procurement was emphasized, as well. Settlement patterns appear to have been oriented initially towards permanent streams and lake margins and by the end of the period, or about A.D. 1000, settlements shifted to more ephemeral water sources as large-body lakes began to desiccate. The persistence of the Medieval Climatic Anomaly may have stressed an already expanding population resulting in the end of the complex by A.D. 1100.

The Late Prehistoric period extends from the close of the Rose Springs Complex ca. A.D. 1100 and ends with the ethnographically described groups occupying the area at contact in the 16th century. It is during this period that Ancestral Puebloan groups are known to have exploited turquoise mines and probably interacted with resident Numic speaking Paiute and Shoshone groups. Numic material culture includes Desert Side-notched and Cottonwood Triangular projectile points, buff and brown ware ceramics, ornaments, milling tools, and rock art. Although interaction spheres have been posited for the region, no clear cultural partitioning is evident so far in the archaeological record despite the linguistic divergence. Obsidian procurement was greatly reduced in the southern and eastern portion of the Mojave Desert perhaps indicating increasing regionalization during this period. It is during this period that the postulated Numic expansion took place out of the Mojave Desert northeastward into the Great Basin. A return of warm and dry conditions, coupled with linguistic evidence, suggest this expansion began sometime before A.D. 1000 (SES 2008a).

Spanish settlement of southern California did not take place until the first mission was established in 1769. At the time, California had the highest Native American population in North America speaking over 300 dialects. The Serrano, a Shoshonean group, were the primary inhabitants of the project area. Serrano lived in large square communal houses and practiced an extensive trade network with the coast. Secularization of the Spanish missions in 1834 led to the development of large ranchos that extended into the interior from the coast. Ranchos often forced Native American groups into a form of indentured servitude. These closed, fortified communal settlements continued after non-Mexican immigrants entered the region. Upon statehood in 1850, industrialization began with the building of railroads, including the Atchison, Topeka & Santa Fe (AT&SF), mining, and the development of military installations (SES 2008a).

Potential Cultural Resources. To date, no formal file and literature review and no intensive cultural resources inventory has taken place in the area of potential effect (APE) along the Lugo-Pisgah ROW. SCE would conduct cultural surveys as part of its CPCN application and PEA that will be submitted to the CPUC for the 850 MW Full Build-Out. As such, the identification of affected cultural resources is limited to broad generalities until such time that an intensive cultural resources inventory can be completed.

Based on the cultural resources overview presented above, it can be expected that a number of prehistoric cultural resources would be identified during inventory for the proposed area of the 850 MW Full Build-Out upgrades. The 275 MW Early Interconnection upgrades would require substantially less ground disturbance and the chance of encountering cultural resources would be reduced. Likely locations for prehistoric archaeological sites include the edges of intermittent drainages, such as those that drain into Antelope Valley near the western end of the project area and ultimately the terraces above the Mojave River. East of the Mojave River it is expected that the number of prehistoric resources will decrease as the corridor extends across Apple and Fifteen-Mile Valleys. However, the many ephemeral drainages that bisect these areas are relict stream channels that could have archaeological sites in association. The margins of both Rabbit Lake and Lucerne Lake also have the potential to contain prehistoric resources. Sites along relict stream channels and desiccated lake margins could include prehistoric campsites and resource processing localities.

Potential historic resources include both the Pisgah and Panoche/Lugo substations, if more than 45-years old, and the 220 kV transmission line that is to be replaced by the new 500 kV line. If these resources meet the age criteria for consideration then a qualified architectural historian must document the resources on appropriate Department of Parks and Recreation (DPR) forms and assess the significance and potential impact to these resources. Other potential historic resources include the crossing of the AT&SF Railroad (two locations) and the California Aqueduct. Numerous other transmission lines would also be crossed.

C.3.8.2 ENVIRONMENTAL IMPACTS

Impacts to cultural resources are unknown pending a formal file and literature review and intensive inventory. Since the proposed 500 kV transmission line corridor would follow an existing ROW for much of its proposed length, it is possible that existing cultural resources have already been impacted. New construction would have the potential to adversely affect cultural resources from ROW/access road construction, blading, equipment storage, pole placement, substation expansion and line installation.

Ground disturbance, the presence of vehicles driving over the top of sites and the installation of new towers could damage archaeological resources. After the work area is defined and after archaeological and historic surveys are complete in any areas that have not been protocol-level surveyed previously by SCE, archaeological sites or historic resources within the built environment may be identified. Depending on when they were built, if the existing SCE 220 kV line or the Pisgah and Panoche/Lugo Substations are determined eligible for the National Register of Historic Places (NRHP), the upgrades and removal effort would result in an impact to historical resources. Other potential historic resources include the crossing of the AT&SF Railroad (two locations) and the California Aqueduct. Whether the impact is significant would need to be determined after the line, substations and/or other infrastructure are evaluated.

Some new lines would be installed in places where there previously were none, and some existing overhead lines would have structures retrofitted and replaced along existing lines. The trench for undergrounding for the Pisgah-Gale fiber optic cable (under the 275 MW Early Interconnection) would normally be excavated in an existing underground cable trench or in a new 600-foot-long trench near the SCE Pisgah Substation, and trenching would not come within 12 inches from any existing fence, wall, or outbuilding associated with an adjacent property. Therefore, there would be no potential to adversely impact the physical condition of existing above-ground cultural resources. The only potential to adversely impact existing above-ground cultural resources would arise from a change in the visual setting of the property due to the addition of taller poles or new poles, new overhead lines, and new substation equipment depending on the location in the project area.

Any potential for the project to impact cultural resources would be limited to undiscovered below-ground cultural deposits. It is possible that buried cultural deposits could be encountered during ground disturbing project activities including trenching for the installation of underground fiber optic cables, during ground disturbance associated with the removal or installation of transmission structures, or ground disturbance associated with the expansion at the Pisgah Substation. The 275 MW Early Interconnection upgrades would require substantially less ground disturbance than the 850 MW Full Build-Out, and the chance of impacting cultural resources would be reduced.

C.3.8.3 MITIGATION

During the CEQA/NEPA environmental permitting process, cultural resources sites would likely be identified and then would be avoided by vehicles and construction activities. After the construction area has been identified and after work for Section 106 has been completed, archaeological sites should be evaluated for eligibility for listing in the NRHP or California Register of Historic Resources (CRHR) if it appears that any would be affected by the project. Sites that have been evaluated as “not eligible” would warrant no further consideration and avoidance would not be required. Sites that have not been evaluated and sites that are considered “potentially eligible” should be treated as eligible resources pending formal evaluation. If found to meet age and significance criteria, the historic resources identified above, including the substations and the existing 220 kV transmission line, would require Level 1 Historic American Engineering Records (HAER) be completed in order to mitigate adverse effects. The crossing of the AT&SF railroad, other historic transmission lines, and the California Aqueduct would likely result in the determination of no adverse effect.

Data recovery should be conducted as a recommended mitigation measure for archaeological sites that are recommended as eligible to the CRHR or NRHP and would be impacted by the project. Monitoring of project-related excavation within an archaeological site is not appropriate mitigation and may destroy the site. SCE should comply with provisions of the National Historic Preservation Act and should consult with a California State Historic Preservation Officer regarding appropriate mitigation should any cultural materials be encountered during construction or other ground-disturbing activities.

In the event of a site discovery during project implementation, all work would stop in the immediate area in order to afford time for documentation, evaluation, and consultation between the lead federal agency, the California State Historic Preservation Officer (SHPO), and all consulting tribes if a discovery is aboriginal in origin. Consultation with the above entities would ensue regardless of whether the discovery is located on private or federal lands. If consultation determines that the discovery is eligible for the NRHP, a consideration of effects should be undertaken pursuant to 36 CFR 800.5 of the National Historic Preservation Act (NHPA, 1966, as amended). If consultation results in a determination of adverse effects to a historic property, mitigation measures would be proposed and implemented following consultation with the California SHPO, the lead federal agency, the Advisory Council on Historic Preservation (ACHP), and all consulting Tribes, if necessary. Avoidance would be the preferable mitigation measure in all instances.

C.3.8.4 CONCLUSION

While SCE would avoid effects to known cultural sites, it is possible that the corridors have sensitive cultural resources that could be affected. This Staff Assessment/EIS concludes that it would be possible to mitigate all impacts to cultural resources to less than a significant level through the Section 106 process and implementation of recommended measures that apply to cultural resources. Known sensitive areas would be avoided, construction activities would be monitored and other appropriate mitigation similar to the Conditions of Certification identified in the **Cultural Resources and Native American Values** section of the Staff Assessment/EIS would be implemented.

C.3.9 CUMULATIVE IMPACTS

Section B.3, Cumulative Scenario, provides detailed information on the potential cumulative solar and other development projects in the project area. Together, these projects comprise the cumulative scenario which forms the basis of the cumulative impact analysis for the proposed project. In summary, these projects are:

- Renewable energy projects on BLM, State, and private lands, as shown on **Cumulative Figures 1 and 2** and in **Cumulative Tables 1A and 1B.** Although not all of those projects are expected to complete the environmental review processes, or be funded and constructed, the list is indicative of the large number of renewable projects currently proposed in California.
- Future development projects in the immediate Newbury Springs/Ludlow area are shown on **Cumulative Impacts Figure 3,** Newbury Springs/Ludlow **Existing and Future/Foreseeable Projects, and Cumulative Tables 2 and 3**. Table 2 presents

existing projects in this area and Table 3 presents future foreseeable projects in the Newbury Springs/Ludlow Area. Both tables provide the project names, types, locations and statuses

These projects are defined within a geographic area that has been identified by the Energy Commission and BLM as covering an area large enough to provide a reasonable basis for evaluating cumulative impacts for all resource elements or environmental parameters. Most of these projects have, are, or will be required to undergo their own independent environmental review under CEQA and/or NEPA. Even if the cumulative projects described in Section B.3 have not yet completed the required environmental processes, they were considered in the cumulative impacts analyses in this SA/Draft EIS.

Geographic Scope of Analysis

The geographic area considered for cumulative impacts on cultural resources is the Calico Solar Project area (Newbury Springs/Ludlow area).

Effects of Past and Present Projects

For this analysis, the following projects or developments are considered most relevant to effects on cultural resources (refer also to Section B.3, Table 2):

Project	Location
Twentynine Palms Marine Corps Air Ground Combat Center (MCAGCC)	Morongo Basin (to the south of project site)
SEGS I and II	Near Daggett (17 miles west of project site)
CACTUS (formerly Solar One and Solar Two)	Near Daggett (to the west of project site)
Mine	2 miles west of project site along I-40
Mine	14 miles west of project site along I-40

Cultural resources in the geographic area have been impacted by past and currently approved projects as follows:

1. Because cultural resources are non-renewable, the removal or destruction of any resource results in a net loss of resources
2. Existing development in the Newbury Springs/Ludlow area and the surrounding areas has resulted in the removal or destruction of cultural resources, which has resulted in a net loss of resources in these areas

Effects of Reasonably Foreseeable Future Projects

Cultural resources are also expected to be affected by the following reasonably foreseeable future projects as follows (refer also to Section B.3, Table 3):

SES Solar Three (CACA 47702)
SES Solar Six (CACA 49540)
SCE Pisgah Substation Expansion

Pisgah-Lugo transmission upgrade
Twentynine Palms Expansion
Broadwell BrightSource (CACA 48875)
Wind project (CACA 48629)
Wind Project (CACA 48667)
Wind project (CACA 48472)
Twin Mountain Rock Venture
Solar thermal (CACA 49429)
Proposed National Monument (former Catellus Lands)
BLM Renewable Energy Study Areas
SES Solar Three (CACA 47702)
SES Solar Six (CACA 49540)
SCE Pisgah Substation Expansion
Pisgah-Lugo transmission upgrade
Twentynine Palms Expansion
Broadwell BrightSource (CACA 48875)
Wind project (CACA 48629)
Wind Project (CACA 48667)
Wind project (CACA 48472)
Twin Mountain Rock Venture
Solar thermal (CACA 49429)
Proposed National Monument (former Catellus Lands)
BLM Renewable Energy Study Areas

Contribution of the Calico Solar Project to Cumulative Impacts

Construction. The construction of the Calico Solar Project is expected to result in permanent adverse impacts related to the removal and/or destruction of cultural resources on the project site during ground disturbance and other construction activities. It is also expected that the construction of some or all of the foreseeable cumulative projects which are not yet built may also result in the permanent adverse impacts as a result of the removal and/or destruction of cultural resources on the sites for those projects. As a result, the construction of the Calico Solar Project and other foreseeable cumulative projects will contribute to permanent long term adverse impacts as a result of the removal and/or destruction of resources on those sites and an overall net reduction in cultural resources in the area.

Operation. During operation of the Calico Solar Project, cultural resources on and in the immediate vicinity of the project site may experience increased vandalism as a result of improved access to the project site, illegal collection of artifacts, and/or destruction of resources by vehicles traveling on the site. Similar impacts may also occur as a result of some or all of the cumulative projects, as more people come into this area associated with those new land uses. As a result, the Calico Solar Project and the other cumulative projects may contribute to a cumulative adverse impact on cultural resources as a result in increased access to the area and the potential for increased vandalism, illegal collection of artifacts, and/or destruction of resources during operation related activities.

Decommissioning. The decommissioning of the Calico Solar Project may result in adverse impacts to cultural resources as a result of ground disturbance, increased vandalism, illegal collection of artifacts, and/or destruction of resources by vehicles traveling on the site or during demolition and removal of the project facilities. Similar impacts are not anticipated as a result of most of the other cumulative projects as the removal of those land uses may not result in increased vandalism, illegal collection of artifacts, and/or destruction of resources by vehicles traveling on those sites or during demolition and removal of those land uses. As a result, decommissioning the Calico Solar Project is not anticipated to contribute to a cumulative adverse impact on cultural resources beyond the contribution of the project that would occur as a result of the construction and operation of the project.

C.3.10 COMPLIANCE WITH LORS

If the Condition of Certification (**CUL-1**) is properly implemented, the proposed Calico Solar Project would result in a less than significant impact under CEQA and resolve effects under Section 106 of the NHPA on known and newly found cultural resources. The project would therefore be in compliance with the applicable state laws, ordinances, regulations, and standards listed in Cultural Resources Table 1.

The County of San Bernardino's General Plan has general language promoting the county-wide preservation of cultural resources. The Condition of Certification requires specific actions not just to promote but to effect historic preservation and mitigate impacts to all cultural resources in order to ensure CEQA compliance. Consequently, if Calico Solar, LLC implements these conditions, its actions would be consistent with the general historic preservation goals of the County of San Bernardino.

C.3.11 NOTEWORTHY PUBLIC BENEFITS

Staff does not discern any public benefits in relation to cultural resources that would occur from the construction, operation, maintenance, or decommissioning of the proposed action that would reasonably be found to be noteworthy.

C.3.12 FACILITY CLOSURE

In the future, Calico Solar Project would experience either a planned closure or be unexpectedly (either temporarily or permanently) closed. When facility closure occurs, it must be done so that it protects the environment and public health and safety. A closure plan would be prepared by the project owner prior to any planned closure. To address unanticipated facility closure, an "on-site contingency plan" would be developed by the project owner and approved by the Energy Commission Compliance Project Manager (CPM). Facility closure requirements are discussed in more detail in the **General Conditions** section of this SA/DEIS. The decommissioning of the Calico Solar Project may result in adverse impacts to cultural resources as a result of ground disturbance, increased vandalism, illegal collection of artifacts, and/or destruction of resources by vehicles traveling on the site or during demolition and removal of the project facilities. Therefore, the protection of cultural resources in the event of either a planned or unplanned closure would be addressed in the development of the Programmatic Agreement.

C.3.13 PROPOSED CONDITION OF CERTIFICATION

CUL-1 The applicant shall be bound to abide, in total, to the terms of the programmatic agreement that the BLM is to execute under 36 CFR § 800.14(b)(3) for the proposed action. If for any reason, any party to the programmatic agreement were to terminate that document and it were to have no further force or effect for the purpose of compliance with Section 106 of the National Historic Preservation Act, the applicant would continue to be bound to the terms of that original agreement for the purpose of compliance with CEQA until such time as a successor agreement had been negotiated and executed with the participation and approval of Energy Commission staff.

Verification: Under the terms of the programmatic agreement, the applicant shall submit all documentation required by the agreement to the Compliance Project Manager (CPM) for review and approval.

C.3.14 CONCLUSIONS AND RECOMMENDATIONS

This cultural resources analysis concludes, on the basis of a 25% sample of the cultural resources inventory of the project area of analysis, that the Calico Solar Project would have significant effects on a presently unknown subset of approximately 139 known prehistoric and historical surface archaeological resources and may have significant effects on an unknown number of buried archaeological deposits, many of which may be determined historically significant under the provisions of a proposed programmatic agreement currently under development as part of the BLM's Section 106 consultation process. The adoption and implementation of Condition of Certification **CUL-1** would reduce the potential impacts of the proposed action on these resources to less than significant under CEQA and would resolve effects under Section 106 of the NHPA, and would further ensure that the proposed action would be in conformity with all applicable LORS.

C.3.15 REFERENCES

The "(tn: 00000)" in a reference below indicates the transaction number under which the item is catalogued in the Energy Commission's Docket Unit. The transaction number allows for quicker location and retrieval of individual items docketed for a case or is used for ease of reference and retrieval of exhibits cited in briefs and used at Evidentiary Hearings.

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used for ease of reference and retrieval of exhibits cited in briefs and used at Evidentiary Hearings.

Jenkins, Olaf P. 1943 – *Manganese in California*. Bulletin 1925, December 1943. State of California, Department of Natural Resources, State Division of Mines, San Francisco, California.

Jones, Thomas S. 1994 – *Manganese Material Flow Patterns*. Information Circular 9399. United States Department of the Interior, Bureau of Mines, Washington, D.C.

Life Magazine – War Metals: Mining Boom Squeezes Strategic Metals from West. *Life Magazine* 13(23): 110-119.

SES 2008a – Stirling Energy Systems/R. Liden (tn 49181). Application for Certification, dated December 1, 2008. Submitted to CEC/Docket Unit on December 1, 2008.

SES 2008b – URS/B. Magdych (tn 49277). Application for Confidential Designation of Cultural Resources Technical Report, dated December 1, 2008. Submitted to CEC/Docket Unit on December 1, 2008.

SES 2009c – URS/R. Nixon (tn 50885). Repeated Application for Confidential Designation of Revised Cultural Resource Technical Report, dated April 6, 2009. Submitted to CEC/Docket Unit April 6, 2009.

SES 2009dd – Stirling Energy Systems/F. Bellows (tn 54229). Applicants' Responses to Energy Commission & Bureau of Land Management's Data Request Set 1, Part 2 Cultural Resources Data Responses & 25% Submittal, dated November 19, 2009. Submitted to CEC/Docket Unit on November 20, 2009.

Time Magazine 1940a – METALS: Cuban Manganese. *Time Magazine*. 1 April 1940. [online]: http://www.time.com/time/magazine/article/0,9171,885872,00.html. Accessed 15 September 2009.

1940b. PROCUREMENT: Montana Manganese. *Time Magazine*. 19 August 1940. [online]:, http://www.time.com/time/magazine/article/0,9171,764396,00.html. Accessed 15 September 2009.

Trask, Parker D. 1950 – *Geologic Description of the Manganese Deposits of California*. Bulletin 152, April 1950. State of California, Department of Natural Resources, State Division of Mines, San Francisco, California.

Williams, Langbourne M., Jr. 1940 – Manganese. *Industrial & Engineering Chemistry* 32(9): 1168-1170. [online]:, http://pubs.acs.org/doi/abs/10.1021/ie50369a016. Accessed 15 September 2009.

Railway Preservation Resources 2006 – *A Survey of Railway Cars and Locomotives on the National Register of Historic Places*. [online]: http://www.railwaypreservation.com/NationalRegister.htm. Accessed 6 November 2009.

U.S. Department of the Interior, National Park Service 2002 – *Bulletin 15: How to Apply the National Register Criteria for Evaluation*. U.S. Department of the Interior, National Park Service, National Register of Historic Places, Washington, D.C.

C.3.15 CULTURAL RESOURCES GLOSSARY

AFC	Application for Certification
ARMR	Archaeological Resource Management Report
CCS	Cryptocrystalline silicate (Cryptocrystalline silicates are rocks such as flint, chert, chalcedony, or jasper that contain a high percentage of silica (SiO^2), the primary compound that composes quartz.)
CEQA	California Environmental Quality Act
CHRIS	California Historical Resources Information System
Conditions	Conditions of Certification
CPM	Compliance Project Manager
CRHR	California Register of Historical Resources
CRM	Cultural Resources Monitor
CRR	Cultural Resource Report
CRS	Cultural Resources Specialist
DPR 523	Department of Parks and Recreation cultural resources inventory form
FAR	Fire-affected rock
FSA	Final Staff Assessment
Historical resource	A cultural resource, for the purpose of CEQA, listed in, or determined to be eligible for listing in, the California Register of Historical Resources (PRC § 21084.1). Subsumed in present analysis under "important historic and cultural aspects of our national heritage."
Historic property	A cultural resource, for the purpose of Section 106, included in, or eligible for inclusion in the National Register of Historic Places (36 CFR § 800.16(l)(1). Subsumed in present analysis under "important historic and cultural aspects of our national heritage."
HRMP	Historical Resources Management Plan
Important historic and cultural aspects of our national heritage	A broadly inclusive term for historically significant cultural resources that encompasses the concepts of "historical resource" and "historic property."
LORS	Laws, ordinances, regulations, and standards
MCR	Monthly Compliance Report
MLD	Most Likely Descendent
NAHC	Native American Heritage Commission
NRHP	National Register of Historic Places

OHP	California Office of Historic Preservation
Programmatic agreement	An agreement document negotiated and drafted under Section 106 of the National Historic Preservation Act of 1969
Project area	The project site, the rights-of-way of all linear and other ancillary power facility features, construction laydown areas, and non-commercial borrow sites
Project area of analysis	The project area and all further areas in which the proposed project has the potential to directly or indirectly affect cultural resources
Project site	The principal proposed plant site parcel or main plant site of which the power block area and the solar thermal field would occupy the majority of that area
Proposed action	Equivalent in present analysis to “proposed project” and “undertaking.” The “proposed action” and other “alternative actions” are developed under NEPA to meet a specified purpose and need.
Proposed project	Equivalent in present analysis to “proposed action” and “undertaking.” A “project,” pursuant to 14 CCR § 15378, “means the whole of an action, which has a potential for resulting in either a direct physical change in the environment, or a reasonably foreseeable indirect physical change in the environment.”
PSA	Preliminary Staff Assessment
SHPO	State Historic Preservation Officer
Staff	Energy Commission cultural resources technical staff
Undertaking	Equivalent in present analysis to “proposed action” and “proposed project.” An undertaking, pursuant to 36 CFR § 800.16(y), “means a project, activity, or program funded in whole or in part under the direct or indirect jurisdiction of a Federal agency, including those carried out by or on behalf of a Federal agency; those carried out with Federal financial assistance; and those requiring a Federal permit, license or approval.”
WEAP	Worker Environmental Awareness Program

Appendix A

SITE DESCRIPTIONS FOR THE 25% SAMPLE OF CULTURAL RESOURCES INVENTORY FOR THE CALICO SOLAR PROJECT

THE RECOMMENDATIONS PRESENTED IN THIS SECTION REGARDING ELIGIBILITY ARE ONLY THOSE OF THE CONTRACTOR, URS, AND DO NOT REFLECT OFFICIAL DETERMINATIONS

This Appendix contains the site descriptions that reflect resurveying approximately 25 percent (%) of the cultural resources sites that were included in the April 2009 revision of the Cultural Resources Technical Report. The California Energy Commission (CEC) and Bureau of Land Management (BLM) cultural resources staff decided that resurveying and collecting supplemental information for a 25% sample of the sites representative of geomorphic landforms would be needed to develop the Preliminary Staff Assessment/Draft Environmental Impact Statement (PSA/DEIS). CEC/BLM selected the 41 sites that would be included in the representative 25% sample.

Archaeologists for the Applicant prepared several sample revised site descriptions that were submitted to BLM/CEC staff for review and comment. The site descriptions in this volume were developed following the format and model of these sample revised site descriptions, including integration of the comments provided by BLM/CEC staff.

Archeologists for the Applicant are in the process of revisiting and collecting the supplemental information requested for the remaining cultural resources sites located on the Proposed Calico Solar Project (Project). This information will be incorporated into a final Cultural Resources Technical Report to be completed during the first quarter of 2010.The cultural resources site descriptions in this appendix have been organized in numeric order based on sitename/number. As stated before, the recommendations are those of proponent's consultant, URS, and not CEC/BLM staff.

CA-SBR-13005

CA-SBR-13005, an amorphous-shaped complex lithic scatter covering a total surface area of 4,558 square meters, is located within the central portion of the Phase 2 area of the Calico Solar Project site. The site area is situated on a nearly level inset alluvial fan facing north northwest. An inset fan comprises the portion of the alluvial deposition in the southern Calico Solar Project area, which is confined between two or more erosional fan remnants (or older higher elevation landforms). These fan types may appear similar to the alluvial fan piedmont or a relict alluvial flat (but without dominant erosional features oriented east to west). Two channels of a northward trending wash transect the site. Poorly developed and poorly sorted desert pavement is present between channels, which is where most of the noted surface artifacts and Locus 1, situated at the southern site boundary, are located. Limited eolian deposits consist of minor accumulations of sand around vegetation, which covers less than 2% of the total site area. Site sediments are fine to medium grained sand with small to large sub-angular to sub-rounded pebbles and cobbles. Approximately 450 meters north of the site is the axial channel for the valley. Fan remnants, low north northwest trending hills, covered by well-developed desert pavement are 200 meters east and west of the site. Vegetation in the site area and vicinity is dominated by the Creosote Bush Community which is characteristic of the Mojave Desert where rainfall is less than 19 centimeters annually. Within the site area, observed vegetation includes creosote bush (*Larrea tridentata*), burrobush (*Ambrosia dumosa*), and desert saltbush (*Artiplex polycarpa*), as well as bunch grasses that were unidentifiable during the archaeological survey.

As noted above, CA-SBR-13005 is an amorphous-shaped, sparse density complex lithic scatter that measures 63 meters north to south by 105 meters east to west; artifact density approximates one artifact per 58.43 square meters (based on GIS calculations). The lithic scatter is composed of 78 artifacts, primarily of red jasper and basalt and includes: lithic debitage, cores, bifaces, and an edge modified flake. One discrete locus with a higher density of jasper debitage specimens at the southern site boundary is interpreted to be single reduction locus. The overall condition of the site is good with two drainages trending north to south cutting through the site.

The major physical surface characteristic of this site is complex scatter containing flaked stone artifacts indicative of lithic reduction activities, including lithic debitage and cores; the site also contains formed flaked stone tools indicative of a wider range of activities beyond lithic reduction, such as bifaces and a unifacially modified flake. Of the 78 artifacts noted on the site surface, 46 are sparsely scattered within the site area, excluding those 32 artifacts noted at Locus 1 (see below). Of these 46 artifacts, 27 are jasper flakes (six primary flakes, eight secondary flakes, seven tertiary flakes, and six pieces of shatter), one white chert secondary flake, seven mustard chert flakes (two primary flakes, one secondary flake, one tertiary flake, and three pieces of shatter), one rhyolite secondary flake, two chalcedony/ chert flakes of unreported color (one secondary flake and one tertiary flake), two green chert flakes (one primary flake and one tertiary flake), and six point provenienced artifacts (three bifacially modified flakes [one of basalt, one of jasper, and one of cryptocrystalline silicate of unreported color], one unifacially modified jasper flake, and two jasper cores of unreported type).

Locus 1, at the southern site boundary, measures 5.6 meters north to south by 1.9 meters east to west and contains 32 red jasper flakes, including 13 primary flakes, six secondary flakes, eight tertiary flakes, and five pieces of shatter.

Although site recordation involved only an examination of the site surface, the potential for buried artifacts at CA-SBR-13005 is high due to reworking of the local sediments by the two northward trending washes that transect the site area. However owing to the active reworking of sediments, buried artifacts, if present, are in secondary disturbed contexts. As well, the likelihood of finding intact buried cultural use surfaces and features is low. Considering the artifact assemblage identified on the site surface which consists two cores, three bifacially modified flakes, one unifacially modified flake, and a large percentage of cortical debitage (21 primary and secondary flakes and nine pieces of shatter, or 30 of the 72 items [42%]), all of which are indicative of initial lithic reduction activities, it is highly likely that any artifacts present in disturbed subsurface contexts would mirror those artifact types identified on the site surface.

Based upon the cultural constituents and the physical context, archaeologists for the Applicant interpret this site as a sparse density complex lithic scatter with a single lithic reduction locality (Locus 1). The lithic materials appear to be derived from cobbles of toolstone quality found on site within the desert pavement surfaces, and the artifact types identified (cores, bifacially modified flakes, and a unifacially modified flake, preponderance of cortical debitage and shatter) reflect initial lithic reduction activities. Such artifacts indicate percussion (hard-hammer and/or soft-hammer) reduction (Andrefsky Jr. 2008; Odell 2004; Whittaker 1994). Additionally, the single discrete locus identified is composed of only one lithic material type (red jasper), which is interpreted as single reduction locus. Thus, the site appears to represent a minimum of one episode of initial lithic reduction and the production of expedient flake tools.

Because this site lacks artifacts with unique or temporally diagnostic characteristics, the material remains cannot be associated with a specific period of prehistory or ethnohistory. Additionally, this site cannot reliably be associated with any distinctive or significant event, person, design, or construction, and analysis of artifact distribution has been accounted for during the recordation process. As noted above, the site is situated on a nearly level inset alluvial fan facing north northwest. Two channels of a northward trending wash transect the site. Poorly developed and poorly sorted desert pavement is present between channels, which is where most of the noted surface artifacts and Locus 1, situated at the southern site boundary, are located. Also noted above, the potential for buried artifacts at CA-SBR-13005 is high due to reworking of the local sediments by the two washes that transect the site area. However, buried artifacts, if present, are in secondary contexts and the likelihood of finding intact buried cultural use surfaces and features is low. As well, considering the artifact assemblage identified on the site surface, it is highly likely that any artifacts present in subsurface contexts would mirror those artifact types identified on the site surface. Therefore, the data potential is considered exhausted through recordation of CA-SBR-13005.

CA-SBR-13009

CA-SBR-13009, an amorphous-shaped prehistoric lithic reduction scatter, is situated along the eastern edge of a large wash. The site covers a total surface area of 845 square meters within the central portion of the Phase 2 area of the Calico Solar Project site. The site is situated on a nearly level (1 degree slope) inset alluvial fan facing north northwest. An inset fan comprises the portion of the alluvial deposition in the southern Calico Solar Project area, which is confined between two or more erosional fan remnants (or older higher elevation landforms). These fan types may appear similar to the alluvial fan piedmont or a relict alluvial flat (but without dominant erosional features oriented east to west). A northward trending slightly incised wash forms the west boundary of the site. Medium to coarse sub-angular grains of sand and small pebbles moderately cover the surface suggesting wind erosion is actively affecting the surface by removing the finer fraction of the sediment. Limited eolian deposits consist of minor accumulations of sand around vegetation, which cover less than two percent of the total site area. Site sediments are fine to medium-grained sand. Approximately 220 meters north of the site is the axial channel for the valley. Fan remnants, low north northwest trending hills, covered by well-developed desert pavement, are 260 meters east and west of the site. The vegetation on site and within the surrounding area consists of the Creosote Bush Community; plant species observed on site include creosote bush (*Larrea tridentata*) and desert saltbush (*Atriplex polycarpa*).

This lithic reduction scatter measures 50 meters east to west by 33.5 meters north to south, and contains a total of 46 lithic artifacts (45 flakes and one core). Artifact density is moderate within the site area (one item per 18.4 square meters); no discrete concentrations of cultural materials or features were identified. The overall condition of the site is good, with no visible alterations except several active rodent burrows.

As noted above, this lithic reduction scatter contains 45 flakes (44 tertiary flakes and one secondary flake). Debitage material types include: 30 flakes of white chert, 10 jasper flakes, three chalcedony flakes, and two flakes of green rhyolite. Additionally, one unidirectional jasper core was identified that defines the extreme southern site boundary.

The potential for buried artifacts at this site is high; however, reworking of the local sediments by the wash suggests that buried artifacts are in a secondary disturbed context and the likelihood of finding intact surfaces and features is low.

Based upon the cultural constituents, archaeologists for the Applicant interpret this lithic reduction scatter as an early-to-late stage biface reduction locality. The prehistoric cultural assemblage is dominated by non-cortical tertiary flakes indicative of the various stages of biface reduction activities. However, because the debitage consists of a variety of cryptocrystalline silicate materials, as well as two flakes of rhyolite, and the debitage is widely scattered throughout the site area, it remains undetermined whether the cultural materials are the result of one or more episodes of early-to-late stage biface reduction. Additionally, due to the absence of any complete bifaces on site, it is probable that any finished tools or bifacial cores or blanks produced on site were carried to an off site location The surface manifestation of this site lacks artifacts with unique or temporally diagnostic characteristics that can be associated with any specific period of prehistory or ethnohistory. Additionally, this site cannot be associated with any distinctive or significant event, person, design, or construction, and the artifact distribution has been documented during the recordation process. Although the potential for buried artifacts at this site is high, due to reworking of the local sediments by the wash, any buried artifacts are likely in secondary and disturbed context, and the chances of finding intact surfaces and features is low. Therefore, the data potential is considered exhausted through recordation of CA-SBR-13009.

CA-SBR-13012H

CA-SBR-13012H, a sparse density, amorphous-shaped historical refuse scatter that also contains two historical/modern rock fire rings (or hearths. The site covers a total surface area of 1,497 square meters within the central portion of the Phase 2 area of the Calico Solar Project site. The site is situated on a nearly level (less than 1 degree slope), southwest-facing rise on a fan skirt in the lower alluvial fan piedmont in the vicinity of coalescing alluvial fans issuing from several gullies merging with the basin floor. The prominent gullies are located approximately 100 meters west and 200 meters east of the site; the axial channel for the basin is located 150 meters south. Two shallow gullies, one branching out into a small fan, transect the northern and southern thirds of the site. Site sediments are fine- to medium-grained sand with few small sub-rounded pebbles. Surface sediments have been slightly reworked by wind, and minor accumulations of sand occur at the base of some vegetation. An older erosional remnant fan, which consists of a series of ridges covered by a well developed desert pavement, is located south of the axial channel, and an alluvial flat is located approximately 200 meters southwest; the slope grades upward into the alluvial piedmont to the north and northeast. Vegetation in the site area and vicinity is dominated by the Creosote Bush Community which is characteristic of the Mojave Desert where rainfall is less than 19 centimeters annually. Within the site area, observed vegetation includes creosote bush (*Larrea tridentata*) and desert saltbush (*Artiplex polycarpa*), as well as bunch grasses that were unidentifiable during the archaeological survey.

The site measures 77 meters north, northwest to south, southeast by a maximum of 48 meters east to west, and as noted above, contains an extremely sparse scatter of historical refuse, as well as two historical/modern surficial fire hearth features (i.e., Features 1 and 2). No discrete concentrations of historical materials were identified, and artifact density is low within the site area (one item per 38.4 square meters). The overall condition of the site is good, with no visible disturbances or alterations.

The historical refuse observed throughout the site area (39 items) appears to range in age from the 1880s to the 1930s or later (ca. 1950s). Historical materials observed include: one sanitary food can measuring 4 5/8" high by 4.0" diameter, one church key-opened sanitary can that measures 2 1/4" high by 4 1/4" diameter, one hole-in-cap lap seam can that measures 4.0" high by 2 3/4" diameter, one hole-in-cap crimp seam can that measures 4 11/16" high by 4.0" diameter, and one external friction lid measuring 5 1/8" diameter. Other cultural materials identified include: one Automatic Bottle Machine (ABM) made clear glass bottle, 13 square cut nails 2 1/2" in length, 12 barrel hoops with wire nails, two railroad track tie plates, and one green glass electrical insulator fragment. Additionally, five pieces of highly weathered milled lumber are present.

Two historical or modern surficial fire hearth features (Features 1 and 2) were also identified on site. Feature 1 is located within the northwestern site area, measures 36 inches north to south by 52 inches east to west (exterior dimensions), 18 inches in interior diameter, and is constructed of a roughly circular, singular course of 15 large sub-rounded metavolcanic cobbles. Feature 2 is located along the central eastern site boundary, measures 31 inches north to south by 36 inches east to west (exterior dimensions), 21 inches in interior diameter, and is constructed of a roughly circular, singular course of 11 medium sized sub-rounded metavolcanic cobbles. No artifacts or charcoal are present at either Feature 1 or Feature 2.

Generally speaking, the local depositional environment suggests that the potential for buried cultural deposits at the site is moderate to high, and buried features or surfaces may be intact as sheet wash and other low energy forms of deposition are common on the lower portions of the alluvial fan piedmont. However, no privy pits or other discrete features (e.g., structure remains or trash dumps) that could potentially contain subsurface cultural remains were identified on site. The nature and age of the cultural deposits identified (an extremely sparse scatter of historical refuse that appears to range in age from the 1880s to the 1930s or later [ca. 1950s], and two historical or modern surficial hearth features) would suggest that the potential for any significant cultural deposits in buried contexts on site is extremely low.

As noted above, the historical refuse on site appears to range in age from the 1880s to the 1930s or 1950s. Whether the two surficial hearths found on site are historical or modern could not be determined; however, there is no evidence to suggest that these features are prehistoric in origin. Artifacts for which general dates of manufacture could be determined include: sanitary cans, hole-in-cap cans, an ABM made bottle, square cut nails, and barrel hoops with wire nails. Sanitary cans were first mass-produced by the Sanitary Can Company in 1904, and in 1908 the American Can Company purchased and took over the four Sanitary Can Company manufacturing plants (IMACS User's Guide 2001:471-6). Sanitary can production dominated can production in the western United States by 1911, but it took nearly 30 more years for it to gain complete control (Fike 1989:22). Additionally, one of the sanitary cans found on site was church key-opened, which indicates that it was opened after 1935 when the church key was first introduced (IMACS User's Guide 2001:471-6). Hole-in-cap cans were produced from 1840 to 1920, but were still being manufactured in small numbers into the 1950s (Goodman 2002). ABM made bottles date from 1904 onward (IMACS User's Guide 2001:472-14) and square cut nails were common until the 1880s when round wire nails began being machine-produced (Goodman 2002).

Due to the close proximity of CA-SBR-13012H to the former alignment of the AP/ATSF Railroad (i.e., CA-SBR-6693H; constructed from 1882 to 1883) and the nature and age of the cultural deposits identified, the archaeologists for the Applicant believe that some of the historical refuse noted on site is likely the result of random episodes of refuse disposal associated with the construction and/or maintenance of CA-SBR-6693H during the late 1800s and early-to-middle 1900s. However, the site is also located immediately south of a well-traveled dirt road, and some of the refuse may be the result of isolated episodes of refuse disposal by people traveling through the area along this road. Whether the two surficial hearths found on site are historical or modern could not be determined; however, there is no evidence to suggest that these features are prehistoric in origin.

Although the local depositional environment suggests that the potential for buried cultural deposits at the site is moderate to high, and buried features or surfaces may be intact as sheet wash and other low energy forms of deposition are common on the lower portions of the alluvial fan piedmont, no privy pits or other discrete features (e.g., structure remains, trash dumps) that could potentially contain subsurface cultural remains were identified on site. The nature and age of the cultural deposits identified would suggest that the potential for any significant cultural deposits in buried contexts on site is extremely low.

CA-SBR-13012H lacks historical artifacts with unique or temporally diagnostic characteristics that can be associated with any specific period of history. Additionally, this site cannot be associated conclusively with any distinctive or significant event, person, design, or construction, and the artifact distribution has been documented during the recordation process. Although the local depositional environment suggests that the potential for buried cultural deposits at the site is moderate to high, no privy pits or other discrete features (e.g., structure remains, trash dumps) that could potentially contain subsurface cultural remains were identified on site. The nature and age of the cultural deposits identified would suggest that the potential for any significant cultural deposits in buried contexts on site is extremely low. Therefore, the data potential is considered exhausted through recordation of CA-SBR-13012H.

CA-SBR-13015

CA-SBR-13015, an amorphous-shaped high density lithic reduction scatter covering a total surface area of 7,238 square meters, is located within the central portion of the Phase 2 area of the Calico Solar Project site. An erosional fan remnant is composed of hills and ridges that extend above, and are surrounded by, the other landforms in the southern portion of the Calico Solar Project site. They generally are composed of a summit with moderate- to well-developed desert pavement (due to both parent material and age) and erosional side slopes that generally lack pavement. Within the southern

Project area, these fan remnants are generally composed of a very old (Early–to-Middle Pleistocene) fanglomerate of cobbles and coarse gravels. Moderate- to well-developed desert pavement covers approximately 90% of the site, and consists of poorly sorted sub-angular to subrounded coarse sand grains, and pebbles and cobbles of cryptocrystalline silicates (e.g., jasper, chert, and chalcedony), basalt, and other volcanic materials. The continuity of the desert pavement is broken by shallow northwest trending gullies dissecting the fan. Most loci and artifacts tend to be located in areas where desert pavement is present. Limited eolian deposits, consisting of small coppice dunes and minor accumulations of sand around the base of vegetation and partially in-filled gullies, cover less than five percent of the site. Along the northern site boundary, the landform discontinuously transitions into an alluvial flat. South of the site the fan remnant extends as a series of low northwest aligned hills covered by moderate- to well-developed desert pavement and separated by similarly oriented washes and gullies. The axial channel for the valley, a 4- to 5-meter-wide west trending wash, is located 270 meters north of the site; prominent northwest trending wash, draining the remnant fan, is located 300 meters west. Vegetation in the site area and vicinity is dominated by the Creosote Bush Community which is characteristic of the Mojave Desert where rainfall is less than 19 centimeters annually. Within the site area, observed vegetation includes creosote bush (*Larrea tridentata*) and desert saltbush (*Artiplex polycarpa*), as well as bunch grasses that were unidentifiable during the archaeological survey.

This high density lithic reduction scatter measures 150 meters north to south by 187 meters east to west, and contains a total of 449 prehistoric artifacts. Artifact density is moderate, with a calculated distribution of one artifact per 16 square meters. However, 22 discrete loci with higher concentrations of cultural materials, interpreted to be single reduction loci, do occur within the site area. The overall condition of this site is good with no alterations.

As noted above, this high density lithic reduction scatter contains 22 discrete reduction loci (i.e., Loci 1-22; see descriptions below) containing higher artifact densities; the remainder of the identified cultural materials are sparsely scattered between loci. In all, 449 artifacts observed on the site surface include: 11 formed tools (all point provenienced), 349 flakes, and 21 pieces of shatter within locus boundaries; six additional formed tools (also point provenienced), 82 flakes, and one piece of shatter are scattered between loci. The formed tools include: nine bifacial cores, three multi-directional cores, one exhausted core, one biface, and one edge-modified flake – all of red jasper. The two remaining tools are chalcedony and include a biface and bifacial core. Of the remaining 432 artifacts, 407 are red jasper, 14 are mustard chert, nine are chalcedony, and two are andesite. The jasper artifacts include 109 primary flakes, 190 secondary flakes, 88 tertiary flakes, and 20 pieces of shatter. The mustard chert artifacts include: seven primary flakes, six secondary flakes, and one piece of shatter. The chalcedony artifacts include three primary flakes, five secondary flakes, and one piece of shatter, while the andesite artifacts include one primary flake and one secondary flake.

Locus 1 is located in the northeastern corner of the site and measures 9.2 meters northeast to southwest by 6.7 meters northwest to southeast. Artifacts at Locus 1 include: one exhausted core, two primary flakes, seven secondary flakes, seven tertiary flakes, and two pieces of shatter – all of red jasper.

Locus 2 is located in the north-central portion of the site and measures 6.0 meters north to south by 3.9 meters east to west. Artifacts at Locus 2 include: one bifacial core, one primary flake, eight secondary flakes, and four tertiary flakes – all of red jasper.

Locus 3 is also located in the north-central portion of the site and measures 4.8 meters north to south by 2.3 meters east to west. Artifacts at Locus 3 include: one bifacial core, two primary flakes, four secondary flakes, and four pieces of shatter – all of red jasper.

Locus 4 is also located in the north-central portion of the site and measures 3.4 meters northwest to southeast by 1.3 meters northeast to southwest. Artifacts at Locus 4 include: six primary flakes, one secondary flake, and one tertiary flake – all of red jasper.

Locus 5 is located in the northwestern portion of the site and measures 13.6 meters northwest to southeast by 6.3 meters northeast to southwest. Artifacts at Locus 5 include: one multi-directional core, one unifacially edge-modified flake, 12 primary flakes, 23 secondary flakes, and 10 tertiary flakes – all of red jasper. One chalcedony secondary flake is also present within this locus.

Locus 6 is also located in the northwestern portion of the site and measures 6.5 meters north to south by 3.6 meters east to west. Artifacts at Locus 6 include: one multi-directional core fragment, two primary flakes, eight secondary flakes, 12 tertiary flakes, and three pieces of shatter – all of red jasper.

Locus 7 is located at the northern site boundary and measures 5.6 meters north to south by 3.2 meters east to west. Artifacts at Locus 7 include: one bifacial core, four secondary flakes and one piece of shatter – all of red jasper.

Locus 8 is located at the northwest corner of the site and measures 5.8 meters northwest to southeast by 2.5 meters northeast to southwest. Artifacts at Locus 8 include: four primary flakes, nine secondary flakes, five tertiary flakes, and one piece of shatter – all of red jasper.

Locus 9 is also located at the northwest corner of the site and measures 4.9 meters northwest to southeast by 2.7 meters northeast to southwest. Artifacts at Locus 9 include: two primary flakes, one secondary flake, seven tertiary flakes, and two pieces of shatter – all of red jasper.

Locus 10 is also located at the west-central site boundary and measures 2.4 meters northwest to southeast by 1.2 meters northeast to southwest. Artifacts at Locus 10 include: two primary flakes, eight secondary flake, one tertiary flake, and one piece of shatter – all of red jasper.

Locus 11 is located at the southwestern site boundary and measures 2.4 meters north to south by 5.4 meters east to west. Artifacts at Locus 11 include: one nearly complete biface, one bifacial core, six primary flakes, 12 secondary flakes, and eight tertiary flakes – all of red jasper. One chalcedony primary flake is also present within the locus boundaries.

Locus 12 is also located at the southwestern site boundary and measures 2.2 meters northeast to southwest by 1.3 meters northwest to southeast. Artifacts at Locus 12 include four primary flakes and five secondary flakes – all of red jasper.

Locus 13 is located at the southwest-central site boundary and measures 2.9 meters northwest to southeast by 0.7 meters northeast to southwest. Artifacts at Locus 13 include: one complete biface, three primary flakes, 12 secondary flakes, and one tertiary flake – all of red jasper.

Locus 14 is located at the southeastern site boundary and measures 3.9 meters northwest to southeast by 1.3 meters northeast to southwest. Artifacts at Locus 14 include: one bifacial core, two primary flakes, three secondary flakes, one tertiary flake, and one piece of shatter – all of red jasper.

Locus 15 is also located at the southeastern site boundary and measures 4.3 meters northeast to southwest by 0.9 meters northeast to southwest. Artifacts at Locus 15 include: seven primary flakes, six secondary flakes, and one piece of shatter – all of mustard chert. Jasper artifacts include three secondary flakes and three tertiary flakes.

Locus 16 is located at the western-central site boundary and measures 2.6 meters north to south by 3.8 meters east to west. Artifacts at Locus 16 include: two primary flakes, three secondary flakes, and one piece of shatter – all of chalcedony. Jasper artifacts include two primary flakes and seven secondary flakes.

Locus 17 is located at the south-central site boundary and measures 0.6 meters north to south by 1.1 meters east to west. Artifacts at Locus 17 include one primary flake and four secondary flakes – all of red jasper.

Locus 18 is also located at the south-central site boundary and measures 1.7 meters north to south by 2.1 meters east to west. Artifacts at Locus 18 include three primary flakes, six secondary flakes, and three tertiary flakes – all of red jasper.

Locus 19 is located in the northeastern corner of the site and measures 0.7 meters north to south by 1.7 meters east to west. Artifacts at Locus 19 include three primary flakes, six secondary flakes, and one piece of shatter – all of red jasper.

Locus 20 is also located in the northeastern corner of the site and measures 6.2 meters north to south by 10.9 meters east to west. Artifacts at Locus 20 include: six primary flakes, 12 secondary flakes, nine tertiary flakes, and one piece of shatter – all of red jasper.

Locus 21 is located in the northeastern site boundary and measures 4.4 meters north to south by 5.6 meters east to west. Artifacts at Locus 21 include: two primary flakes, eight secondary flakes, five tertiary flakes, and one piece of shatter – all of red jasper.

Locus 22 is located in the central portion of the site and measures 7.0 meters northwest to southeast by 2.1 meters northeast to southwest. Artifacts at Locus 22 include: one primary flake, 13 secondary flakes, one tertiary flake, and one piece of shatter – all of red jasper.

To summarize, a total of 349 pieces of debitage/shatter and 11 tools are located within the 22 loci. As noted above, six formed artifacts and 82 debitage items and one piece of shatter were identified between loci. The formed artifacts include three bifacial jasper cores, two multi-directional jasper cores, and one bifacial chalcedony core. Debitage items observed between loci include: 79 jasper flakes (43 primary flakes, 26 secondary flakes, and 10 tertiary flakes) and one piece of jasper shatter, two andesite flakes (one primary and one secondary), and one secondary flake of chalcedony.

The potential for buried artifacts is low as geologic sources indicate the fan remnant dates to the Early-to- Middle Pleistocene (Rogers 1967); however, artifacts associated with the surface pavement may be covered by eolian sands in limited areas (approximately five percent) of the site. However, considering the artifact assemblage identified on site which consists primarily of various types of cores and a large percentage of cortical debitage (342 of 432 debitage items, or 79%), all of which are indicative of initial lithic reduction activities, it is highly likely that any artifacts present in subsurface contexts would mirror those artifact types already identified.

Based upon the cultural constituents and the physical context, archaeologists for the Applicant interpret this site as a lithic procurement and initial lithic reduction locality. The lithic materials appear to be derived from cobbles of toolstone quality found on site within the desert pavement surfaces, and the artifact types identified (primarily bifacial and multi-directional cores and a preponderance of cortical debitage) reflect initial lithic reduction activities. Such artifacts indicate percussion (hard-hammer and/or soft-hammer) reduction (Andrefsky Jr. 2008; Odell 2004; Whittaker 1994). Additionally, each of the 22 loci identified are composed primarily of only one type of lithic material (jasper, chert, or chalcedony); these are interpreted as single reduction loci. Thus, the site appears to represent a minimum of 22 episodes or localities of initial lithic reduction.

Because this site lacks artifacts with unique or temporally diagnostic characteristics, the material remains cannot be associated with any specific period of prehistory or ethnohistory. Additionally, this site cannot reliably be associated with any distinctive or significant event, person, design, or construction, the artifact distribution has been documented during the recordation process. As noted above, CA-SBR-13015 is situated on the toe slope of a gently sloping erosional fan remnant facing north and northwest, moderate to well-developed desert pavement covers approximately 90% of the site, and most loci and artifacts tend to be located in areas where desert pavement is present. The potential for buried artifacts is low as geologic sources indicate the fan remnant dates to the Early-to-Middle Pleistocene (Rogers 1967), prior to human presence in the area. Artifacts associated with the surface pavement may be covered by eolian sands in limited areas (approximately five percent) of the site. However, considering that the artifact assemblage identified on site consists primarily of cores and a large percentage of cortical debitage (74.3% of the debitage identified), all of which are indicative of initial lithic reduction activities, it is highly likely that any artifacts present in subsurface contexts would mirror those artifact types already identified. Therefore, the data potential is considered exhausted through recordation of CA-SBR-13015.

CA-SBR-13026

CA-SBR-13026, an amorphous-shaped sparse density lithic reduction scatter covering a total surface area of 5,435 square meters, is located within the southern central portion of the Phase 2 area of the Calico Solar Project site. The site is situated on a gently sloping (2 to 3 degree) toe slope of an erosional fan remnant facing west. The erosional fan remnant is composed of hills and ridges that extend above, and are surrounded by, the other landforms in the southern portion of the Calico Solar Project area. They generally are composed of a summit with moderate- to well-developed desert pavement (due to both parent material and age) and erosional side slopes that generally lack pavement. Within the southern project area, these fan remnants are generally composed of a very old (Early-to-Middle Pleistocene) fanglomerate of cobbles and coarse gravels. Poorly to moderate-developed desert pavement covers approximately 70% of the site, and consists of poorly sorted sub-angular to sub-rounded pebbles and cobbles of basalt, cryptocrystalline silicates, rhyolite, and metavolcanic materials. The continuity of the desert pavement is broken by shallow west and southwest trending gullies dissecting the surface. All loci and most artifacts tend to be located in areas where desert pavement is present. Limited eolian deposits consist of small accumulations of sand around the base of vegetation and partially in-filled gullies and cover less than five percent of the site area. Site sediments consist of fine to medium grained sand with sub-angular to sub-rounded pebbles and cobbles of the material types noted above. South of the site is an inset fan with braided west trending channels; small coppice dunes have formed on vegetation stabilized bars. The remnant fan extends both north and east and consists of low northwest trending eroded hills covered by a well-developed desert pavement. Vegetation in the site area and vicinity is dominated by the Creosote Bush Community which is characteristic of the Mojave Desert where rainfall is less than 19 centimeters annually. Within the site area, observed vegetation includes creosote bush (*Larrea tridentata*), burrobush (*Ambrosia dumosa*), and desert saltbush (*Artiplex polycarpa*), as well as bunch grasses that were unidentifiable during the archaeological survey.

This sparse density lithic reduction scatter measures 130 meters north to south by 124 meters east to west, and contains a total of 90 prehistoric artifacts. Artifact density is low, with a calculated distribution of one artifact per 64.7 square meters. However, four discrete loci with higher concentrations of cultural materials, interpreted to be single reduction loci, do occur within the site area. The overall condition of this site is good with no alterations.

The major physical surface characteristic of this site is a lithic reduction scatter containing approximately 89 cryptocrystalline silicate (jasper and chalcedony), rhyolite, and metavolcanic artifacts, which include: 79 pieces of lithic debitage, seven cores, two tested cobbles, and one hammerstone. Of the 89 artifacts identified, 37 pieces of debitage and two cores occur within four discrete loci (i.e., Loci 1-4) with higher concentrations of artifacts situated on poorly to moderate-developed desert pavement surfaces; the remaining cultural materials identified occur outside of these designated loci.

Locus 1 is located along the central-western site boundary, measures 4.0 meters north to south by 4.0 meters east to west, and contains 10 red/pink/white banded jasper flakes (three primary flakes, two secondary flakes, and five tertiary flakes).

Locus 2 is located within the central-eastern site area, measures 5.0 meters north to south by 3.0 meters east to west, and contains 14 green rhyolite flakes (one primary flake, six secondary flakes, and seven tertiary flakes).

Locus 3 is located approximately 15 meters northeast of Locus 2, measures 2.2 meters north to south by 2.2 meters east to west, and contains seven jasper flakes (two primary flakes, one secondary flake, and four tertiary flakes) and one unidirectional jasper core.

Locus 4 is located near the southeastern site boundary approximately 20 meters south southeast of Locus 2, measures 1.6 meters north to south by 1.0 meter east to west, and contains six green rhyolite flakes (two primary flakes, three secondary flakes, and one tertiary flake) and one unidirectional rhyolite core.

Those artifacts identified outside of the designated loci (50 items) include: five cores (one bifacial jasper core, one jasper core [type unreported], two multi-directional chalcedony cores, and one multi-directional rhyolite core), one metavolcanic cobble hammerstone, two tested cobbles (one jasper and one red-white mottled cryptocrystalline silicate), and 42 lithic debitage items including 13 primary flakes (seven jasper, four cryptocrystalline silicate, one rhyolite, and one metavolcanic), 17 secondary flakes (nine jasper, seven cryptocrystalline silicate, and one metavolcanic), six tertiary flakes (three jasper, two cryptocrystalline silicate, and one agate), and six pieces of shatter (four jasper and two cryptocrystalline silicate).

The potential for buried artifacts is low as geologic sources indicate the fan remnant dates to the Early-to- Middle Pleistocene (Rogers 1967); however, artifacts associated with the surface pavement may be covered by eolian sands in limited areas (approximately five percent) of the site. However, considering the artifact assemblage identified on site, which consists of cores, tested cobbles, a hammerstone, and a large percentage of cortical debitage (50 of 79 debitage items, or 63.3%), all of which are indicative of initial lithic reduction activities, it is highly likely that any artifacts present in subsurface contexts would mirror those artifact types already identified.

Based upon the cultural constituents and the physical context, archaeologists for the Applicant interpret this site as a sparse density lithic procurement and initial lithic reduction locality. The lithic materials appear to be derived from cobbles of toolstone quality found on site within the desert pavement surfaces. The artifact types identified (unidirectional, multi-directional, and bifacial cores, a hammerstone, and a preponderance of cortical debitage) reflect initial lithic reduction activities. Such artifacts indicate percussion (hard-hammer and/or soft-hammer) reduction (Andrefsky Jr. 2008; Odell 2004; Whittaker 1994). Additionally, all four loci identified comprised only one type of lithic material (either jasper or rhyolite), which are interpreted as single reduction loci. Thus, the site appears to represent a minimum of four episodes or localities of initial lithic reduction.

This site lacks artifacts with unique or temporally diagnostic characteristics and the material remains cannot be associated with a specific period of prehistory or ethnohistory. As noted above, CA-SBR-13026 is situated on a gently sloping toe slope of an erosional fan remnant facing west, poorly to moderate-developed desert pavement covers approximately 70% of the site, and all loci and most artifacts tend to be located in areas where desert pavement is present. The potential for buried artifacts is low as geologic sources indicate the fan remnant dates to the Early-to-Middle Pleistocene (Rogers 1967), prior to human presence in the area. Artifacts associated with the surface pavement may be covered by eolian sands in limited areas (approximately five percent) of the site. However, considering the artifact assemblage identified on site, which consists of cores, tested cobbles, a hammerstone, and a large percentage of cortical debitage (63.3% of the debitage identified), all of which are indicative of initial lithic reduction activities, it is highly likely that any artifacts present in subsurface contexts would mirror those artifact types already identified. Therefore, the data potential is considered exhausted through recordation of CA-SBR-13026.

CA-SBR-13029

CA-SBR-13029, an amorphous-shaped, low density lithic reduction scatter covering a total surface area of 1,188 square meters, is located in the extreme northwestern corner of the western edge of the Phase 2 area of the Calico Solar Project site. The site is situated on a moderately dissected region of the uppermost portion of the alluvial fan piedmont. The alluvial fan piedmont is the large, gently sloping depositional feature that dominates the northern portion of the Calico Solar Project area; commonly referred to as a “bajada.” As a whole, this appears to be a much younger landform than those in the southern portion of the Calico Solar Project area. A mountain valley draining the Cady Mountains opens onto the fan 500 meters northeast and numerous active and abandoned channels are braided across the area. Specifically, the site is on a slightly elevated stabilized remnant of the fan, although likely not much older than the surrounding area. Within the site area, slope ranges from three to five percent with generally a southeastern aspect. Southeast trending braided washes bound the east and west side of the site and extend for several hundred meters in width. Site sediments are fine to medium grained sand with small to medium sub-angular pebbles and cobbles of cryptocrystalline silicates (e.g., jasper, chert, and chalcedony), basalt, and other volcanic materials. Evenly distributed, moderately sorted cobbles are scattered across the surface of much of the site. Limited eolian deposits consist of minor accumulations of sand at the base of vegetation, which covers no more than one percent of the site. The mountain valley is moderately large and continues for approximately 5 miles into the mountains; the piedmont descends gently to the southeast. Vegetation in the site area and vicinity is dominated by the Creosote Bush Community which is characteristic of the Mojave Desert where rainfall is less than 19 centimeters annually. Within the site area, observed vegetation includes creosote bush (*Larrea tridentata*), burrobush (*Ambrosia dumosa*), and desert saltbush (*Artiplex polycarpa*), as well as bunch grasses that were unidentifiable during the archaeological survey.

CA-SBR-13029 is an amorphous-shaped, sparse density lithic reduction scatter that measures 53 meters north to south by 33 meters east to west; artifact density approximates one artifact per 74 square meters (based on GIS calculations). The site is composed of 16 pieces of debitage, including five secondary flakes and four tertiary flakes of red jasper, three secondary flakes and two tertiary flakes of mustard chert, and one secondary flake and one tertiary flake of white chert. No formed tools are present on the site surface. One highly weathered, unidentifiable large mammal long bone midsection was also observed on the site surface.

Although site recordation involved only an examination of the site surface, the potential for buried artifacts at this site is high. However, due to reworking of the local sediments by the wash, buried artifacts are likely in secondary disturbed context and the chances of finding intact surfaces and features is low.

Based upon the cultural constituents and the physical context, archaeologists for the Applicant interpret this site as a sparse density, lithic reduction scatter with only 16 debitage items present on the site surface derived from cobbles of red and brown jasper of toolstone quality found on site within the desert pavement surfaces. These types of sites are characterized by the presence of lithic debitage – indicating testing and initial production of flaked stone-tools; such as bifacial cores and scrapers. The presence of nine secondary flakes (red jasper, and white and mustard colored chert) and seven tertiary flakes of the same material types as the secondary flakes suggest that maintenance of tools of these material types may have occurred at the site. However, the tools were likely transported off site, as no formed tools were present on the site surface.

Because this site lacks artifacts with unique or temporally diagnostic characteristics, the material remains cannot be associated with a specific period of prehistory or ethnohistory. Additionally, this site cannot reliably be associated with any distinctive or significant event, person, design, or construction. The artifact distribution has been documented during the recordation process. As noted above, the site is situated on a slightly elevated stabilized remnant on the uppermost portion of an alluvial fan piedmont fan. Although the potential for buried artifacts at this site is high, buried artifacts are likely in secondary disturbed context due to reworking of the local sediments by the wash; the chances of finding intact surfaces and features is low. Therefore, the data potential is considered exhausted through recordation of CA-SBR-13029.

CA-SBR-13032

CA-SBR-13032 is a prehistoric trail composed of four distinct segments that trend north northwest to south southeast (Segments 1 and 2); as the trail extends further west, it trends in almost an east to west direction (Segments 3 and 4). The site is situated in the east-central portion of the Phase 1 area of the Calico Solar Project site. The trail likely extends further to the east outside the Calico Solar Project site. The site is situated in a moderately dissected region of the upper portion of an alluvial fan piedmont near the mountain front and transects three or four major drainage systems. The alluvial fan piedmont is the large, gently sloping depositional feature that dominates the northern portion of the Calico Solar Project site, commonly referred to as a “bajada.” Several mountain valleys originating in the Cady Mountains open onto the piedmont uphill, or north northeast, of the site and are the source for a number of coalescing braided washes and their associated fans. Generally, the surface slopes 3 to 4 degrees, with a southwest aspect. The trail is most visible in areas where the site surface is densely covered by poorly sorted sub-angular cobbles and small boulders; however, much of the site does transect areas that are covered by more sorted pebbles and cobbles and even sand. Numerous channels cross the ground surface in the site area and have eliminated any manifestation of the trail system. Portions of the trail pass close to several basaltic or andesite inselburgs and generally follows the base of the mountains at a contour interval of +/- 2,430-40 feet above mean sea level.

Vegetation along the trail is part of the Creosote Bush Community which is characteristic of the Mojave Desert where rainfall is less than 19 centimeters annually. Along the site area, observed vegetation includes: creosote bush (*Larrea tridentata*), burrobush (*Ambrosia dumosa*), desert saltbush (*Artiplex polycarpa*), teddy bear cholla (*Opuntia bigelovii*), pencil cholla (*Opuntia* sp.), and beavertail cactus (*Opuntia basilaris*), as well as bunch grasses that were unidentifiable during the archaeological survey.

The combined length of the four recorded segments at CA-SBR-13032 is 2,349 meters; all four trail segments range in width from 40 to 50 centimeters and are less than 5.0 centimeters deep. The trail follows a nearly level contour (noted above), crossing undulating terrain, with intact portions generally present on the higher terraced areas. Where seasonally wet washes transect the trail, evidence of the trail has been eliminated. The surface of the trail appears to be tamped with evidence of the manual cast-off of larger cobbles to either side; this is more evident on occasional terraces with rocky surfaces. It is likely that the trail continues both to the west northwest and east southeast; the eastern segment of the trail continues to the southeast outside the Calico Solar Project site. Extending from east to west, the Segments are numbered 1, 2, 3, and 4; Segment descriptions are provided below.

Segment 1 is 881 meters long, trending in a northwest to southeast direction along a moderate-developed desert pavement terrace. The segment is divided into 18 sub-Sections (1A-R) by seasonally wet washes. In some areas, the trail is slightly bermed along the sides where it transects the cobble pavement. One jasper secondary flake was noted adjacent to Trail Segment 1R. A faint side trail 11 meters long by 25 centimeters wide runs parallel along the southern portion of Trail Segment 1C of the main trail segment.

Segment 1 is the eastern-most trail segment recorded and likely extends further east outside the Calico Solar Project site.

Segment 2 is 249 meters long, trending in a west northwest to east southeast direction along developed desert pavement. The segment is divided into two sub-Sections (2A and B) due to natural erosion. The eastern portion of the trail segment is well defined as it passes over highly developed desert pavement; the central to western portions are less defined, but clearly visible from the correct angle (pavement is nonexistent or insipient). The sections of the trail located atop developed desert pavement areas are defined by larger cobbles; in non-pavement areas the ground surface has been tamped and subsequently filled with aeolian sands. Feature 2, composed of three courses of granitic cobbles, is located on the north side of Trail Segment 2A. Segment 2 is located west of Segment 1.

Segment 3 is 1,120 meters long, trending in an east to west direction along a moderate-developed desert pavement terrace. The segment is divided into seven sub-Sections (3A-G) by seasonally wet washes. In some areas, the trail is slightly bermed along the sides where it transects the cobble pavement. Feature 1, composed of three courses of granitic cobbles, is located on the south side of Trail Segment 3D; one secondary chalcedony flake was noted adjacent to Trail Segment 3A, and another secondary chalcedony flake was noted adjacent to Trail Segment 3D. Segment 3 is located west of Segment 2.

Segment 4 is 22 meters long, and also trends in an east to west direction along a moderate-developed desert pavement terrace. The segment is divided into five sub-Sections (4A-E) by seasonally wet washes. In some areas, the trail is slightly bermed along the sides where it transects the cobble pavement. A cluster of five white quartzite secondary flakes and a white quartzite biface were noted adjacent to Trail Segment 4A. Segment 4 is located west of Segment 3.

In addition to the trail itself, two cairn features (Features 1 and 2) are also present. Feature 1, composed of three courses of granitic cobbles, is located on the south side of Trail Segment 3D and measures 50 centimeters wide by 83 centimeters long and is 25 centimeters high. Feature 2, composed of three courses of granitic cobbles, is located on the north side of Trail Segment 2A and measures 50 centimeters wide by 60 centimeters long and is 20 high. With the exception of the eight artifacts described above, no additional prehistoric or historical artifacts were noted adjacent to the trail system.

The overall condition of the prehistoric trail that constitutes CA-SBR-13032 is poor because portions of the trail that travel through seasonally wet washes have been completely destroyed; other trail segments situated atop the terraced desert pavement surfaces are minimally impaired from natural erosion.

Based upon the cultural constituents and the physical context, CA-SBR-13032 is clearly a portion of a larger prehistoric trail system that transects the Calico Solar Project site. Features 1 and 2, the two rock cairns recorded at the site, are presumed to have functioned as “trail markers.” The few artifacts noted along the trail are likely the result of sporadic lithic reduction activities of those individuals who utilized the trail. It is of note that the only quartzite artifacts noted during the 25 percent Calico Solar site re-survey completed to address Data Request Number 97, are present at CA-SBR-13032, adjacent to Trail Segment 4A.

CA-SBR-13041

CA-SBR-13041 is an amorphous-shaped prehistoric complex lithic scatter covering a total surface area of 82,565 square meters within the northwestern quadrant of the Phase 1 area of the Calico Solar Project site. The northern site boundary is bordered by a dirt access road within a gas pipeline corridor approximately 40 meters to the north of CA-SBR-13041; a barbed wire fence borders and defines portions of the southern site boundary. The CA-SBR-13041 is situated on a gently sloping (1 to 3 degree slope) inset alluvial fan facing north northwest with a wide northwest trending wash and several isolated erosional fan remnants. The inset alluvial fan comprises the portion of the alluvial deposition in the southern Calico Solar Project site, which is confined between two or more fan remnants (or older higher elevation landforms). These fan types may appear similar to the fan piedmont or the alluvial flat (but without dominant erosional features oriented east to west). The erosional fan remnant includes the hills and ridges that extend above, and are surrounded by, the other landforms in the southern portion of the Calico Solar Project site. They generally are composed of a summit with moderate- to well-developed desert pavement (due to both parent material and age) and erosional side slopes that generally lack pavement. Within the southern Calico Solar Project site, these fan remnants are generally composed of a very old (Early-to-Middle Pleistocene) fanglomerate of cobbles and coarse gravels.

Active channels of the wash are located east and west of the site and have been modified and incised due to the changes in local hydrology from the construction of Interstate 40. In the southwest corner of the site an erosional fan remnant dominates a portion of the fan. The fan remnant consists of low ridges covered by a well developed desert pavement, separated by north trending gullies. A similar, yet, lower formation is located in the northeast corner of the site. A wash consisting of a network of braided channels transects the remainder of the site. Portions of the wash are covered with a moderately sorted and poorly to moderate-developed desert pavement broken by occasional channels in-filled with eolian sediments. Limited eolian deposits consist of small coppice dunes and minor accumulations of sand around the base of vegetation and cover less than five percent of the site. Loci and most artifacts identified at the site tend to be located in areas where desert pavement is present. In addition to the two gullies east and west of the site, a west trending wash draining the erosional fan remnant is approximately 80 meters north and the axial channel for the valley is located 1,400 meters north. Fan remnants, consisting of a series of older low ridges and gullies covered with moderate- to well-developed desert pavement are located between 700 and 1,000 meters northeast, east, south, and west of the site.

Vegetation in the site area and vicinity is dominated by the Creosote Bush Community which is characteristic of the Mojave Desert where rainfall is less than 19 centimeters annually. Within the site area, observed vegetation includes creosote bush (*Larrea tridentata*), white bursage or burrobush (*Ambrosia dumosa*), and desert saltbush (*Artiplex polycarpa*), as well as bunch grasses that were unidentifiable during the archaeological survey.

CA-SBR-13041 is a sparse density complex lithic scatter measuring 535 meters east to west by 260 meters north to south and composed of nine discrete lithic reduction loci; a sparse scatter of lithic debitage, battered stone, and flaked stone tools is present between loci. Covering a surface area of 82,565 square meters, artifact density is one artifact per 110 square meters (based on GIS calculations). A total of 753 artifacts were observed on the site surface, including 63 formed artifacts that were point provienced and mapped (Artifacts #s 1-48 [Artifact #27 includes two cores; Artifact #25 includes three cores]). Of the 63 point provienced artifacts, 19 artifacts assigned formal Artifact Numbers (including Artifact #25 [Artifacts #s 1-48 are fully described in Table 2-1, Descriptions of Artifacts from CA-SBR-41 given Formal Artifact Numbers]) are located within designated loci (Loci 2, 3, 5, 6, 7, and 9); an additional six tools are also located within designated loci but were not given formal Artifact Numbers (there are 25 total formed artifacts mapped within the loci). Thirty additional artifacts are mapped outside designated locus boundaries and were assigned formal Artifact Numbers; eight additional tools are also located outside designated locus but were not given formal Artifact Numbers (there are 38 total formed artifacts located outside the designated loci). The total 63 formed tools observed site wide include: 32 red jasper cores, four mustard chert cores, and two chert cores of unreported color (38 total cores); seven red jasper edge-modified flakes (seven total edge-modified flakes); eight red jasper bifaces/fragments, one mustard chert biface/fragment, and one grey banded chert biface/fragment (10 total bifaces/fragments); one rhyolite hammerstone and one andesite hammerstone (2 total hammerstones); two red jasper flake tools and one brown/tan chert flake tool (three total flake tools); one grey chert uniface; one red jasper scraper; and one red jasper utilized flake.

The remaining artifacts observed on the site surface include: 690 flakes/shatter specimens, including 531 red jasper flakes/shatter specimens, 71 mustard chert flakes/shatter specimens, 69 brown/tan chert flakes/shatter specimens, eight white chert flakes/shatter specimens, eight red/white banded chert flakes/shatter specimens, and three green chert flakes/shatter specimens. The jasper flakes/shatter specimens include: 120 primary flakes, 236 secondary flakes, 98 tertiary flakes, and 77 pieces of shatter. The mustard chert flakes/shatter specimens include: nine primary flakes, 21 secondary flakes, 32 tertiary flakes, and nine pieces of shatter. The brown/tan chert flakes/shatter specimens include: 11 primary flakes, 30 secondary flakes, 17 tertiary flakes, and 11 pieces of shatter. The white chert flakes/shatter specimens include four primary flakes and four secondary flakes. The red/white banded chert flakes/shatter specimens include four primary flakes and four secondary flakes. The green chert flakes/shatter specimens include: one secondary flake, one tertiary flake, and one piece of shatter. One cleared rock circle feature (Feature 1) is also present in the northeastern corner of Locus 5. Locus descriptions are provided below.

Locus 1 is located in the northwestern corner of the site and measures 6.0 meters north to south by 11.4 meters east to west. Artifacts at Locus 1 include: three primary flakes, three secondary flakes, two tertiary flakes, and two pieces of shatter – all of red jasper. One tertiary flake of mustard chert and one piece of chalcedony shatter are also present at Locus 1.

Locus 2 is also located in the northwestern portion of the site and measures 4.4 meters north to south by 3.7 meters east to west. Artifacts at Locus 2 include three primary flakes and four secondary flakes – all of red jasper. Artifacts 12 and 13 are also located in Locus 2.

Locus 3 is located at the west-central site boundary and measures 9.5 meters north to south by 11.8 meters east to west. Artifacts at Locus 3 include: one primary flake, five secondary flakes, 19 tertiary flakes, and two pieces of shatter – all of mustard chert. Red jasper artifacts include two secondary flakes and one piece of shatter. Artifacts 43 and 44 are also located in Locus 3.

Locus 4 is located along the barbed wire fence line at the southwestern portion of the site and measures 7.4 meters north to south by 7.9 meters east to west. Artifacts at Locus 4 include 17 tertiary flakes and seven pieces of shatter – all of mustard chert. The brown/tan chert artifacts at Locus 4 include one primary flake and one piece of shatter; one red jasper secondary flake is also present.

Locus 5 is located in the southwestern corner of the site and measures 15 meters north to south by 28 meters east to west. Artifacts at Locus 5 include: 15 primary flakes, 12 secondary flakes, three tertiary flakes, and five pieces of shatter – all of red jasper. The brown/tan chert artifacts at Locus 5 include two primary flakes, one secondary flake, and two pieces of shatter. Other artifacts at Locus 5 include one rhyolite primary flake, one mustard chert primary flake, and one white chert primary flake; Artifact 42, a jasper core and a CCS core not assigned formal Artifact Numbers, and the Feature 1 rock circle are also present at Locus 5.

Locus 6 is located in the northern, west central site area and measures 29 meters northeast to southwest by 11 meters northwest to southeast. Both red jasper flakes/shatter and brown/tan chert flakes/shatter are present at Locus 6. The red jasper artifacts include: seven primary flakes, 19 secondary flakes, two tertiary flakes, and 12 pieces of shatter. The brown/tan chert artifacts include: three primary flakes, 11 secondary flakes, nine tertiary flakes, and two pieces of shatter. Artifacts 23 and 40, and a jasper core not assigned a formal Artifact Number are also present at Locus 6.

Locus 7 is located in the north-central site area and measures 6.0 meters north to south by 11.5 meters east to west. Artifacts at Locus 7 include: 12 primary flakes, eight secondary flakes, 22 tertiary flakes, and 12 pieces of shatter – all of red jasper. Two primary and one secondary flakes of mustard chert, as well as Artifacts 24 and 25 are also present at Locus 7.

Locus 8 is located at the south-central site boundary and measures 11 meters north to south by 11 meters east to west. Artifacts at Locus 8 include: three primary flakes, four secondary flakes, one tertiary flake, and one piece of shatter – all of red jasper.

Locus 9, the largest locus at CA-SBR-13041, is located in the east-central portion of the site and measures 32 meters north to south by 265 meters east to west. Locus 9 also contains the most diverse lithic material types and formed tools of all nine loci. Red jasper artifacts include: 10 primary flakes, 105 secondary flakes, 29 tertiary flakes, and 14 pieces of shatter. Brown/tan artifacts include: one primary flake, 14 secondary flakes, four tertiary flakes, and five pieces of shatter. Green chert artifacts include: one primary flake, eight secondary flakes, one tertiary flake, and one piece of shatter. Gray chert artifacts include two secondary flakes and three tertiary flakes. The red/white chert artifacts include a primary flake and a tertiary flake. Artifacts 29, 30, 34, 35, 36, 37, 38, and 39, as well as two jasper cores and a gray banded chert core not assigned formal Artifact Numbers are also present at Locus 9.

In areas of the washes that transect the northeastern and northwestern portions of the site, the potential for buried artifacts is high; however, due to reworking of the local sediments by the wash, buried artifacts are apt to be in secondary disturbed context and the likelihood of finding intact surfaces and features is low. The potential for buried artifacts on the fan remnants is low as geologic sources indicate the fan remnant dates to the Early-to-Middle Pleistocene. Intact desert pavement may be covered by eolian deposits on less than five percent of the site. Considering that the artifact assemblage identified on site consists primarily of cores (39 total cores), or 62% of the formed tools) and cortical flakes/shatter (530 total cortical flakes/shatter), or 77% of the debitage/shatter assemblage), all of which are indicative of early stage lithic reduction activities, it is highly likely that any artifacts present in subsurface contexts would mirror those artifact types already identified.

Based upon the cultural constituents and the physical context, archaeologists for the Applicant interpret this site as a lithic procurement and early stage lithic reduction locality. The lithic materials appear to be derived from cobbles of toolstone quality found on site within the desert pavement surface. The artifact types identified (unidirectional, multi-directional, and bifacial cores, and a preponderance of cortical debitage and shatter) reflect early stage lithic reduction activities. Such artifacts indicate percussion (hard-hammer and/or soft-hammer) reduction (Andrefsky Jr. 2008; Odell 2004; Whittaker 1994). The presence of bifaces, a scraper, a utilized flake, a flake tool, and a uniface also suggests that later stage reduction activities were also undertaken at the site.

Because CA-SBR-13041 lacks artifacts with unique or temporally diagnostic characteristics, the material remains cannot be associated with any specific period of prehistory or ethnohistory. Additionally, this site cannot reliably be associated with any distinctive or significant event, person, design, or construction, and the artifact distribution has been documented during the recordation process. As noted above, CASBR-13041 is situated on a gently sloping (1 to 3 degree slope) inset alluvial fan facing north northwest with a wide northwest trending wash and several isolated erosional fan remnants. Although the potential for buried artifacts at this site is high in the areas of active washes, reworking of the local sediments by the washes suggests that buried artifacts are in secondary disturbed context, and the likelihood of finding intact surfaces or features is low. Additionally, considering that the artifact assemblage identified on site consists primarily of cores and a large percentage of cortical flakes and shatter (39 of 47 debitage items, or approximately 83.3%), all of which are indicative of initial lithic reduction activities, it is highly likely that any artifacts present in subsurface contexts would mirror those artifact types already identified.

As a result, CA-SBR-13041, as a stand-alone or individual resource, is recommended not eligible for the National Register of Historic Places, and is not a historic property pursuant to the National Register or a historical resource per the California Register of Historic Resources under any of the criteria for eligibility. In addition, CA-SBR-13041 is not considered a contributor to an existing or proposed archaeological district or landscape. No further cultural resources management of this resource is recommended.

CA-SBR-13053

CA-SBR-13053 is an amorphous-shaped moderate density c lithic reduction scatter situated near the toe of the Cady Mountains approximately 1,617 meters south of the northern Project area of potential effect (APE) and 1,477 meters north northeast of the Project's Proposed Main Services Complex. The site covers a total surface area of 641 square meters within the northwestern portion of the Phase 1 area of the Calico Solar Project site. The site is located in the uppermost portions of the alluvial fan piedmont on the eastern toe slope of a remnant hill; the hill constitutes the non-buried portions of a spur ridge extending from the Cady Mountains to the north. The alluvial fan piedmont is the large, gently sloping depositional feature that dominates the northern portion of the Calico Solar Project area; commonly referred to as a "bajada." As a whole, this appears to be a much younger landform than those in the southern portion of the Calico Solar Project area. A larger and higher remnant hill is located 100 meters north. Within the site area, slope ranges from 4 to 6 degrees with a generally southeastern aspect. A south trending braided wash bounds the eastern end of the site, and extends for several hundred meters further to the east. Additional remnant hills and the southern termini of south trending spur ridges extending from the Cady Mountains are located both east and west of the site area. Site sediments are fine to medium grained sand with small to large sub-angular pebbles and cobbles of cryptocrystalline silicates (e.g., jasper, chert, and chalcedony), basalt, and other volcanic materials. Evenly distributed, moderately sorted cobbles are scattered across the surface of much of the site. Limited eolian deposits consist of small coppice dunes forming around the base of vegetation, and the accumulation of sand at the base of the hill in the form of a small sand sheet; these eolian deposits cover no more than five percent of the site. Vegetation on site and within the surrounding area consists of the Creosote Bush Community; plant species observed on site include creosote bush (*Larrea tridentata*), white bursage or burrobush (*Ambrosia dumosa*), as well as bunch grasses that were unidentifiable during survey.

This lithic reduction scatter measures a maximum of 82 meters east to west by 45 meters north to south, and contains a total of 37 prehistoric artifacts (36 flakes and one biface fragment), the majority of which (30 items, or 81%) are concentrated within the western site area within an area designated as Locus 1. Artifact density at CA-SBR-13053 is moderate, with a calculated distribution of one artifact per 17.3 square meters. The overall condition of the site is good with no visible disturbances or alterations; minimal evidence of off-highway vehicle (OHV) activity is present to the north northwest of the site.

Locus 1 is located within the western site area, and measures 10.5 meters north to south by 9.0 meters east to west. Artifacts identified within Locus 1 include one point provenienced chalcedony biface fragment and 29 flakes (four chalcedony secondary flakes, 24 chalcedony tertiary flakes, and one tertiary flake of moss agate).

Those artifacts observed outside of the Locus 1 (seven items) include five chalcedony flakes (one primary and four tertiary), one jasper tertiary flake, and one chert tertiary flake.

The potential for buried artifacts at this site is high; however, due to reworking of the local sediments by the wash, buried artifacts are likely in secondary disturbed context, and the chances of finding intact surfaces and features is low.

Based upon the cultural constituents, archaeologists for the Applicant interpret this moderate density lithic reduction scatter as an early-to-late stage biface reduction locality. The site’s lithic assemblage consists of a single biface fragment and 36 flakes, 86% of which are non-cortical tertiary flakes indicative of early-to-late stage biface reduction activities. Because the majority of lithic materials found within this lithic reduction scatter (91.9%) are of the same stone material (chalcedony), the site appears to represent one single episode or locality of early-to-late stage biface reduction. The lack of complete bifaces on site suggests that any finished tools, bifacial cores, or blanks produced on site were carried to an offsite location.

The surface manifestation of this site lacks artifacts with unique or temporally diagnostic characteristics that can be associated with a specific period of prehistory or ethnohistory. Additionally, this site cannot be associated with any distinctive or significant event, person, design, or construction, and the artifact distribution has been documented during the recordation process. Although the potential for buried artifacts at this site is high, due to reworking of the local sediments by the wash, any buried artifacts are likely in secondary and disturbed context, and the chances of finding intact surfaces and features is low. Therefore, the data potential is considered exhausted through recordation of CA-SBR-13053.

CA-SBR-13054

CA-SBR-13054 is an amorphous-shaped high density lithic reduction scatter covering a total surface area of 345 square meters near the toe of the Cady Mountains within the northeastern portion of the Phase 1 area of the Calico Solar Project site. The site is situated on a gently sloping (3 to 4 degree slope) south facing small erosional remnant fan in an active wash emanating from the Cady Mountains in the upper portions of the alluvial fan piedmont. The erosional fan remnant involves the hills and ridges that extend above, and are surrounded by, the other landforms in the southern portion of the Calico Solar Project area. They generally are composed of a summit with moderately- to well-developed desert pavement (due to both parent material and age) and erosional side slopes that generally lack pavement.

Within the southern Calico Solar Project site, these fan remnants are generally composed of a very old (Early-to-Middle Pleistocene) fanglomerate of cobbles and coarse gravels. The alluvial fan piedmont is the large, gently sloping depositional feature that dominates the northern portion of the Calico Solar Project site; commonly referred to as a “bajada.” As a whole, this appears to be a much younger landform than those in the southern portion of the Calico Solar Project site.

Older erosional fan remnants are located east and west flanking the wash; spur ridges terminate several hundred meters north upslope of the older fan remnants. Moderate-developed very poorly sorted desert pavement consisting of angular to sub-angular clasts ranging in size from pebbles to small boulders covers most of the site; clasts of toolstone quality materials (i.e., cryptocrystalline silicates) are present within the pavement. The continuity of the desert pavement is broken by several small south trending shallow gullies transecting the eastern portion of the site. Subsurface sediments are gravelly, fine to coarse sands. Most artifacts tend to be located within areas where pavement is present. South of the site, the alluvial fan piedmont continues and multiple coalescing fans are present east and west where mountain canyons open onto the piedmont. Vegetation in the site area and vicinity is dominated by the Creosote Bush Community which is characteristic of the Mojave Desert where rainfall is less than 19 centimeters annually. Within the site area, observed vegetation includes creosote bush (*Larrea tridentata*), white bursage or burrobush (*Ambrosia dumosa*), and desert saltbush (*Artiplex polycarpa*), as well as bunch grasses that were unidentifiable during the archaeological survey.

This high density lithic reduction scatter measures 29 meters north to south by 33 meters east to west, and contains a total of 50 prehistoric lithic artifacts. Artifact density is moderate, with a calculated distribution of one artifact per 7.0 square meters. However, no discrete concentrations of cultural materials occur within the site area. The overall condition of this site is good with no alterations.

The major physical surface characteristic of this site is a lithic reduction scatter containing approximately 50 cryptocrystalline silicate (jasper and chalcedony) artifacts, which include: 47 pieces of jasper debitage (two primary flakes, six secondary flakes, eight tertiary flakes, and 31 pieces of shatter), two jasper cores (one bifacial core and one multi-directional core), and one chalcedony unidirectional core.

The potential for buried artifacts at this site is high; however, reworking of the local sediments by the wash suggests that buried artifacts are in secondary disturbed context, and the likelihood of finding intact surfaces and features is low. Additionally, considering that the artifact assemblage identified on site consists primarily of cores and a large percentage of cortical flakes and shatter (39 of 47 debitage items, or approximately 83.3%), all of which are indicative of initial lithic reduction activities, it is highly likely that any artifacts present in subsurface contexts would mirror those artifact types already identified.

Based upon the cultural constituents and the physical context, archaeologists for the Applicant interpret this site as a high density lithic procurement and initial lithic reduction locality. The lithic materials appear to be derived from cobbles of toolstone quality found on site within the desert pavement surface. The artifact types identified (unidirectional, multi-directional, and bifacial cores, and a preponderance of cortical debitage and shatter) reflect initial lithic reduction activities. Such artifacts indicate percussion (hard-hammer and/or soft-hammer) reduction (Andrefsky Jr. 2008; Odell 2004; Whittaker 1994). Because the vast majority of the lithic materials found within this lithic reduction scatter (98%) are of the same stone material (jasper), the site appears to represent one single episode or locality of initial lithic reduction.

Because this site lacks artifacts with unique or temporally diagnostic characteristics, the material remains cannot be associated with any specific period of prehistory or ethnohistory. Additionally, this site cannot reliably be associated with any distinctive or significant event, person, design, or construction, and documentation of the artifact distribution has been conducted during the recordation process. As noted above, CA-SBR-13054 is situated on a gently sloping (3 to 4 degree slope) south facing small remnant fan in an active wash, moderate-developed desert pavement covers most of the site area, and most artifacts tend to be located within areas where pavement is present. Although the potential for buried artifacts at this site is high, reworking of the local sediments by the wash suggests that buried artifacts are in secondary disturbed context, and the likelihood of finding intact surfaces or features is low. Additionally, considering that the artifact assemblage identified on site consists primarily of cores and a large percentage of cortical flakes and shatter (39 of 47 debitage items, or approximately 83.3%), all of which are indicative of initial lithic reduction activities, it is highly likely that any artifacts present in subsurface contexts would mirror those artifact types already identified. Therefore, the data potential is considered exhausted through recordation of CA-SBR-13054.

CA-SBR-13059

CA-SBR-13059 is an amorphous-shaped sparse density complex lithic scatter, covering a total surface area of 45,365 square meters, located along the southern boundary within the southwestern quadrant of the Phase 2 area of the Calico Solar Project site. The site is situated on the toe slope of a nearly level erosional fan remnant facing northwest. The erosional fan remnant constitutes the hills and ridges that extend above, and are surrounded by, the other landforms in the southern portion of the Calico Solar Project site. They generally are composed of a summit with moderate- to well-developed desert pavement (due to both parent material and age) and erosional side slopes that generally lack pavement. Within the southern Calico Solar Project site, these fan remnants are generally composed of a very old (Early-to- Middle Pleistocene) fanglomerate of cobbles and coarse gravels. Moderate- to well-developed desert pavement covers approximately 70% of the site and consists of moderately sorted sub-angular to subrounded coarse sand grains, and pebbles and cobbles of cryptocrystalline silicates (e.g., jasper, chert, and chalcedony), basalt, and other volcanic materials. The continuity of the desert pavement is broken by shallow northwest trending gullies dissecting the fan. Most loci and artifacts tend to be located in areas where desert pavement is present. Limited eolian deposits consisting of small coppice dunes and minor accumulations of sand around the base of vegetation and partially in-filled gullies cover less than five percent of the site surface. Along the northern site boundary, the landform discontinuously transitions into an alluvial flat. South of the site the fan remnant extends as a series of low northwest aligned hills covered by moderate- to well-developed desert pavement and separated by similarly oriented washes and gullies. The axial channel for the valley, a 4- to 5-meter-wide west trending wash, is located 300 meters north of the site. A prominent northwest trending wash draining the fan remnant forms the western boundary of the site.

Vegetation in the site area and vicinity is dominated by the Creosote Bush Community which is characteristic of the Mojave Desert where rainfall is less than 19 centimeters annually. Within the site area, observed vegetation includes creosote bush (*Larrea tridentata*), white bursage or burrobush (*Ambrosia dumosa*), and desert saltbush (*Artiplex polycarpa*), as well as bunch grasses that were unidentifiable during the archaeological survey.

CA-SBR-13059 is a sparse density complex lithic scatter measuring 380 meters north northwest to south southeast by 363 meters east to west, covering a total surface area of 45,365 square meters; artifact density approximates one artifact per 66 square meters (based on GIS calculations). The site includes 34 discrete concentrations of lithic materials with a higher artifact density (see loci descriptions below). Observed artifacts at CA-SBR-13059 total 692, including 25 cores and tools with Formal Artifact Numbers within designated loci, an additional 14 items with Formal Artifact Numbers are located outside designated locus boundaries (see Table 2-2 for a complete description of these artifacts). An additional two tested cobbles and one biface fragment without Formal Artifact Numbers are located within locus boundaries (Locus 15 and Locus 10, respectively), while an additional 11 core tools (10 red jasper and one mustard jasper – all of unreported core type) and four tested cobbles without Formal Artifact Numbers are located outside locus boundaries. The remaining 636 artifacts are debitage items, including flakes of red jasper, mustard and red jasper, chalcedony, mottled chert, and green chert; of these, 554 pieces of debitage and 26 pieces of shatter are located within designated locus boundaries; 56 pieces of debitage are located outside designated locus boundaries.

The debitage assemblage located within locus boundaries includes: 131 primary flakes, 185 secondary flakes, 109 tertiary flakes, and 23 pieces of shatter – all of red jasper; 23

primary flakes, 48 secondary flakes, 28 tertiary flakes and one piece of shatter – all of mustard and red jasper; five primary flakes, seven secondary flakes, eight tertiary flakes and one piece of shatter – all of chalcedony; and five primary flakes, two secondary flakes, three tertiary flakes and one piece of shatter – all of an unreported color of chert (total number of 554 flakes, and a total number of 26 shatter). The debitage assemblage located outside locus boundaries include: 22 primary flakes, 22 secondary flakes, and three tertiary flakes – all of red jasper; two primary flakes and four secondary flakes of chalcedony; two tertiary flakes of green chert; and one basalt secondary flake (total of 56 flakes).

The overall condition of the site is fair. The area is a popular location for rock hounding and there is a prospect pit at the extreme northwestern corner of the site; Locus 6 also appears to represent a looter's discard pile.

As noted above, 34 discrete loci with higher artifact density are present on the site; description of these are provided below.

Locus 1, located in the northeastern portion of the site, measures 1.8 meters north northwest to south southeast by 0.8 meters east northeast to west southwest and includes five secondary flakes, and one tertiary flake—all of red jasper.

Locus 2, also located in the northeastern portion of the site, measures 5.3 meters northeast to southwest by 1.7 meters northwest to southeast and includes six primary flakes and nine secondary flakes—all of red jasper. Artifact 34 is also present.

Locus 3, also located in the northeastern portion of the site, measures 2.3 meters northwest to southwest by 1.3 meters northwest to southeast and includes three primary flakes, seven secondary flakes, and five tertiary flakes—all of chalcedony. One primary flake and two tertiary flakes of red jasper are also present.

Locus 4, also located in the northeastern portion of the site, measures 11.9 meters northwest to southeast by 8.7 meters northeast to southwest and includes: nine primary flakes, 11 secondary flakes, five tertiary flakes, and one piece of shatter—all of red jasper. Artifact 32 is also present.

Locus 5, located in the east-central portion of the site, measures 8.4 meters north to south by 2.6 meters east to west and includes: seven primary flakes, 10 secondary flakes, and four tertiary flakes—all of red jasper. Artifacts 35 and 36 are also present.

Locus 6, located at the extreme southeastern corner of the site, measures 1.0 meter north to south by 1.0 meter east to west and includes core fragments of an unreported type and 13 pieces of mustard and red jasper material; Artifact 5 is also present. Given the very small size of the locus and the fact that all the noted lithic materials are situated in a deflated pile, Locus 6 appears to represent a looter's discard pile.

Locus 7, located at the very northern site boundary in the northeastern corner of the site, measures 4.3 meters northeast to southwest by 3.0 meters northwest to southeast and includes: three primary flakes, five secondary flakes, and five tertiary flakes—all of red jasper. Artifact 3 is also present.

Locus 8, located in the central portion of the site, measures 3.9 meters north to south by 3.7 meters east to west and includes 13 secondary flakes and seven tertiary flakes—all of red jasper. Artifacts 8 and 16 are also present.

Locus 9, also located in the central portion of the site, measures 3.5 meters north to south by 2.1 meters east to west and includes 10 secondary flakes, four tertiary flakes, and three pieces of shatter—all of red jasper.

Locus 10, located in the west-central portion of the site, measures 4.1 meters north to south by 3.6 meters east to west and includes three primary flakes, three secondary flakes, and seven tertiary flakes—all of red jasper. Artifact 12 is also present.

Locus 11, also located in the west-central portion of the site, measures 2.9 meters north to south by 3.0 meters east to west and includes five primary flakes and four secondary flakes—all of mustard jasper.

Locus 12, located in the east-central portion of the site, measures 2.7 meters north to south by 0.7 meters east to west and includes three primary flakes, four secondary flakes, and three tertiary flakes—all of red jasper. Artifact 19 is also present.

Locus 13, located at the northern site boundary in the northwestern corner of the site, measures 14 meters north to south by 6.8 meters east to west and includes: 17 primary flakes, 11 secondary flakes, 15 tertiary flakes, and three pieces of shatter—all of red jasper.

Locus 14, also located at the northern site boundary in the northwestern corner of the site, measures 7.2 meters northeast to southwest by 3.5 meters northwest to southeast and includes: seven primary flakes, four secondary flakes, six tertiary flakes, one piece of shatter—all of red jasper. Artifacts 30 and 31 are also present.

Locus 15, also located at the northern site boundary in the northwestern corner of the site, measures 5.6 meters north to south by 2.7 meters east to west and includes four secondary flakes, one tertiary flake, one piece of shatter—all of an unreported color of chert.

Locus 16, located at the very southern site boundary in the western portion of the site, measures 3.7 meters northwest to southeast by 1.5 meters northeast to southwest and includes one primary flake, two secondary flakes, and one tertiary flake—all of red jasper. One primary flake and three secondary flakes of chalcedony are also present, as well as Artifact 39.

Locus 17, located at the extreme western edge of the site, measures 14 meters north to south by 31 meters east to west and includes: 18 primary flakes, 17 secondary flakes, five tertiary flakes, and one piece of shatter—all of red jasper. One additional primary flake of chalcedony is also present, as well as Artifacts 13, 14, and 15.

Locus 18, also located at the extreme western edge of the site, measures 4.7 meters north to south by 7.0 meters east to west and includes: nine primary flakes, 14 secondary flakes, eight tertiary flakes, and two pieces of shatter—all of red jasper.

Locus 19, located at the extreme eastern edge of the site, measures 2.4 meters northwest to southeast by 1.5 meters northeast to southwest and includes two primary flakes, five secondary flakes, and three tertiary flakes—all of red jasper.

Locus 20, also located at the extreme eastern edge of the site, measures 2.7 meters north to south by 3.2 meters east to west and includes two primary flakes, six secondary flakes, four tertiary flakes, and one piece of shatter—all of red jasper.

Locus 21, located in a dense concentration of loci at the east-central edge of the site, measures 2.5 meters north to south by 2.3 meters east to west and includes nine primary flakes, five secondary flake, and three tertiary flakes—all of red jasper. Artifact 17 is also present.

Locus 22, also located in a dense concentration of loci at the east-central edge of the site, measures 8.9 meters northeast to southwest by 9.0 meters northwest to southeast and includes nine primary flakes, 10 secondary flakes, five tertiary flakes, and one piece of shatter—all of red jasper.

Locus 23, also located in a dense concentration of loci at the east-central edge of the site, measures 3.2 meters northeast to southwest by 2.7 meters northwest to southeast and includes 12 primary flakes, 19 secondary flakes, and 13 tertiary flakes—all of red jasper.

Locus 24, also located in a dense concentration of loci at the east-central edge of the site, measures 1.4 meters north to south by 2.4 meters east to west and includes five primary flakes, two secondary flakes, two tertiary flakes, one piece of shatter—all of assorted CCS of unreported color.

Locus 25, also located in a dense concentration of loci at the east-central edge of the site, measures 9.6 meters north to south by 7.6 meters east to west and includes four primary flakes, 11 secondary flakes, and eight tertiary flakes—all of mustard and red jasper. Artifact 21 is also present.

Locus 26, also located in a dense concentration of loci at the east-central edge of the site, measures 3.0 meters north to south by 6.6 meters east to west and includes seven primary flakes, 10 secondary flakes, three tertiary flakes, and one piece of shatter—all of mustard and red jasper. Artifacts 22 and 23 are also present.

Locus 27, also located in a dense concentration of loci at the east-central edge of the site, measures 4.7 meters northwest to southeast by 2.4 meters northeast to southwest and includes three primary flakes, four secondary flakes, and four tertiary flakes—all of mustard and red jasper. Artifact 24 is also present.

Locus 28, also located in a dense concentration of loci at the east-central edge of the site, measures 3.0 meters northeast to southwest by 1.7 meters northwest to southeast and includes three primary flakes, 10 secondary flakes, and 10 tertiary flakes—all of mustard and red jasper.

Locus 29, also located in a dense concentration of loci at the east-central edge of the site, measures 4.0 meters north to south by 4.7 meters east to west and includes six primary flakes, 13 secondary flakes, and three tertiary flakes—all of mustard and red jasper.

Locus 30, also located in a dense concentration of loci at the east-central edge of the site, measures 4.7 meters northeast to southwest by 4.6 meters northwest to southeast and includes nine primary flakes, seven secondary flakes, one tertiary flake, and four pieces of shatter—all of red jasper. Artifacts 25 and 26 are also present.

Locus 31, located at the very southeastern site boundary, measures 1.6 meters north to south by 9.5 meters east to west and includes three primary flakes, four secondary flakes, four tertiary flakes, and three pieces of shatter—all and red jasper. Artifacts 28 and 29 are also present.

Locus 32, located at the very northern site boundary in the northeastern corner of the site, measures 5.6 meters north to south by 3.1 meters east to west and includes two primary flakes, three flakes, and four tertiary flakes—all of red jasper.

Locus 33, also located at the very northern site boundary in the northeastern corner of the site, measures 1.4 meters north to south by 1.0 meter east to west and includes three primary flakes and two secondary flakes—all of chalcedony.

Locus 34, located at the east-central site boundary, measures 1.6 meters north to south by 5.6 meters east to west and includes six primary flakes, six secondary flakes, and four tertiary flakes—all of red jasper.

The potential for buried artifacts at CA-SBR-13059 is low, as geologic sources indicated the erosional fan remnant dates to the Early-to-Middle Pleistocene. Although portions of the fan surface and desert pavement may be covered by eolian deposits or the gully fan at the southern side of the site, only five percent of the site surface is covered by these deposits. Considering that the artifact assemblage identified on site consists primarily of cores (total number of 32, or 64% of the formed artifacts), six tested cobbles, 26 shatter, and a preponderance of cortical debitage (total of 404, or 73% of the debitage assemblage), it appears that early stage lithic reduction was the primary activity undertaken at the site. The presence of bifaces and 148 tertiary flakes of various lithic material types also suggests that later stage reduction activities were also undertaken at the site. Thus, based on the artifact assemblage and the low potential for buried cultural deposits in the five percent of the site surface covered by eolian deposits or the gully fan at the southern side of the site, it is highly likely that any artifacts present in subsurface contexts would mirror those artifact types already identified.

Based upon the cultural constituents and the physical context, archaeologists for the Applicant interpret this site as a complex lithic scatter composed primary of cores and cortical debitage and shatter that are derived from cobbles of toolstone quality found on site within the desert pavement surface. The artifact types identified (multi-directional and bifacial cores, and a preponderance of cortical debitage and shatter) reflect early stage lithic reduction activities. Such artifacts indicate percussion (hard-hammer and/or softhammer) reduction (Andrefsky Jr. 2008; Odell 2004; Whittaker 1994). The presence of bifaces and 148 tertiary flakes also suggests that later stage reduction activities were also undertaken at the site.

CA-SBR-13059 lacks artifacts with unique or temporally diagnostic characteristics. As noted above, the potential for buried artifacts at CA-SBR-13059 is low, and although portions of the fan surface and desert pavement may be covered by eolian deposits or the gully fan at the southern side of the site, only five percent of the site surface is covered by these deposits. Additionally, considering that the artifact assemblage identified on site consists primarily of cores and a large percentage of cortical flakes and shatter, it is highly likely that any artifacts present in subsurface contexts would mirror those artifact types already identified.

CA-SBR-13069

CA-SBR-13069, an amorphous-shaped, moderate density lithic reduction scatter covering a total surface area of 323 square meters, is located at the western edge of the Phase 2 area of the Calico Solar Project site. The site is situated on a fan remnant within a nearly level inset alluvial fan facing west northwest. This fan remnant is an earlier surface within the fan prior to the active channel down-cutting in its current course and abandoning this portion of the inset fan; it is much younger than the erosional fan remnant. The alluvial fan piedmont is the large, gently sloping depositional feature that dominates the northern portion of the Calico Solar Project site; commonly referred to as a “bajada.” As a whole, this appears to be a much younger landform than those in the southern portion of the Calico Solar Project site.

Older and more elevated fan remnants are located both north and south of the site, bounding the inset fan. The main channel of a west northwestward trending wash is located 150 meters south of the site. Moderately developed and moderately sorted desert pavement covers the entire surface area of the site, suggesting this portion of the alluvial fan is temporarily stabilized. Desert pavement continues east and west, broken by small gullies and small drainage features. A short slope near the southern boundary of the site is moderately dissected by small short gullies. Below the slope, south of the site, is the currently active portion of the inset fan. Site sediments are fine to medium-grained sand with small to large subangular to sub-rounded pebbles and cobbles. Approximately one-half mile northwest is the axial channel for the valley. The toe slopes of older fan remnants are located both north and south of the site and are covered by well-developed desert pavement. Vegetation in the site area and vicinity is dominated by the Creosote Bush Community which is characteristic of the Mojave Desert where rainfall is less than 19 centimeters annually. Within the site area, observed vegetation includes creosote bush (*Larrea tridentata*), burrobush (*Ambrosia dumosa*), and desert saltbush (*Artiplex polycarpa*), as well as bunch grasses that were unidentifiable during the archaeological survey.

CA-SBR-13069 is an amorphous-shaped, moderate density lithic reduction scatter that measures 37 meters east to west by 41 meters north to south; artifact density approximates one artifact per 20.2 square meters (based on GIS calculations). The site contains one lithic reduction locus (Locus 1) measuring 3.2 meters northeast to southwest by 1.0 meter northwest to southeast which is composed of three primary flakes and six secondary flakes of red jasper; two primary and five secondary flakes of red jasper are located outside of Locus 1 boundaries. Total observed artifacts at CA-SBR-13069 include five primary and 11 secondary flakes of red jasper; no formed tools were observed at CA-SBR-13069.

Although site recordation involved only an examination of the site surface, the potential for buried artifacts at this site is relatively low as the local landform has stabilized; however, if buried artifacts are present, reworking of the local sediments by the wash suggest that the artifacts would be in secondary disturbed contexts, and the likelihood of finding intact buried cultural use surfaces and features is low.

Based upon the cultural constituents and the physical context, archaeologists for the Applicant interpret this site as a moderate density, lithic reduction scatter with a single lithic reduction locality (Locus 1) with higher artifact densities than the site as a whole. The lithic materials appear to be derived from cobbles of red jasper of toolstone quality found on site within the desert pavement surfaces. The flakes types identified (cortical debitage) reflect initial lithic reduction activities. Such artifacts indicate percussion (hard-hammer and/or soft-hammer) reduction (Andrefsky Jr. 2008; Odell 2004; Whittaker 1994). Thus, the site appears to represent a minimum of one episode of initial lithic reduction. Because this site lacks artifacts with unique or temporally diagnostic characteristics, the material remains cannot be associated with a specific period of prehistory or ethnohistory. As noted above, the site is situated on a fan remnant within a nearly level inset alluvial fan that is bounded by older and more elevated fan remnants. Moderately developed and moderately sorted desert pavement covers the entire surface area of the site, suggesting this portion of the alluvial fan is temporarily stabilized. As noted above, the potential for buried artifacts at this site is relatively low as the local landform has stabilized. Nonetheless, if buried artifacts are present, reworking of the local sediments by the wash suggest that the artifacts would be in disturbed secondary contexts and the likelihood of finding intact buried cultural use surfaces and features is low. Therefore, the data potential is considered exhausted through recordation of CA-SBR-13069.

CA-SBR-13071

CA-SBR-13071, an amorphous-shaped, moderate density lithic reduction scatter covering a total surface area of 5,363 square meters. It is located within the central portion of the Phase 2 area of the Calico Solar Project site. The site is situated on the toe slope of a nearly level (1 degree slope) erosional fan remnant facing northwest. The erosional fan remnant constitutes the hills and ridges that extend above, and are surrounded by, the other landforms in the southern portion of the Calico Solar Project site. They generally are composed of a summit with moderate- to well-developed desert pavement (due to both parent material and age) and erosional side slopes that generally lack pavement. Within the southern Project area, these fan remnants are generally composed of a very old (Early-to-Middle Pleistocene) fanglomerate of cobbles and coarse gravels. Moderate- to well-developed desert pavement covers approximately 70% of the site and consists of poorly sorted sub-angular to subrounded coarse sand grains, and pebbles and cobbles of cryptocrystalline silicates (e.g., jasper, chert, and chalcedony), basalt, and other volcanic materials. The continuity of the desert pavement is broken by shallow northwest trending gullies dissecting the fan. Most loci and artifacts tend to be located in areas where desert pavement is present. Limited eolian deposits consisting of small coppice dunes and minor accumulations of sand around the base of vegetation and partially in-filled gullies cover less than five percent of the site. Along the northern site boundary, the landform discontinuously transitions into an alluvial flat. South of the site, the fan remnant extends as a series of low northwest aligned hills covered by moderate- to well-developed desert pavement, and separated by similarly oriented washes and gullies.

One such gully terminates at the southern boundary of the site forming a small gully fan covering the older remnant surface. The axial channel for the valley, a four- to five-meter-wide, west-trending wash, is located 250 meters north of the site. A prominent northwest trending wash, draining the remnant fan, is located 400 meters southwest. Vegetation in the site area and vicinity is dominated by the Creosote Bush Community which is characteristic of the Mojave Desert where rainfall is less than 19 centimeters annually. Within the site area, observed vegetation includes creosote bush (*Larrea tridentata*), burrobush (*Ambrosia dumosa*), and desert saltbush (*Artiplex polycarpa*), as well as bunch grasses that were unidentifiable during the archaeological survey.

This sparse density lithic reduction scatter measures 160 meters east to west by 75 meters north to south, and contains a total of 211 prehistoric artifacts. Artifact density is moderate, with a calculated distribution of one artifact per 26 square meters. However, nine discrete loci with higher concentrations of cultural materials, interpreted to be single reduction loci, do occur within the site area. The overall condition of this site is fair; off-highway vehicle (OHV) disturbance and plowing/disking activities are evident within a small area in the northeastern portion of the site, southwest of Locus 1.

As noted above, the major physical surface characteristic of this site is a moderate density lithic reduction scatter containing approximately 211 artifacts (199 jasper artifacts, seven basalt artifacts, four chalcedony artifact, and one chert artifact). These items include: 190 pieces of lithic debitage, eight cores (two unidirectional cores, four bifacial cores, and two multi-directional cores), and 13 tested cobbles. Of the 211 artifacts identified, 141 items occur within locus boundaries (i.e., Loci 1-09), including 127 pieces of lithic debitage, nine tested cobbles, and five cores. Loci 2-9 are situated on moderate- to well-developed desert pavement surfaces; Locus 1 is located on a portion of the alluvial flat that occurs discontinuously along the northern site boundary. Formed tools assigned formal artifact numbers located within locus boundaries include Artifact 2 at Locus 1; Artifact 3 at Locus 4; Artifact 4 at Locus 5; Artifact 5 at Locus 6; Artifact 7 at Locus 7); formed tools assigned formal artifact numbers located outside designated locus boundaries include three jasper cores (one bifacial, one unidirectional, and one multi-directional [Artifact Nos. 1, 6, and 8]). Of the remaining 203 non-tool artifacts, 195 are jasper, six are basalt, one is chalcedony, and one is chert. The jasper artifacts include 58 primary flakes, 72 secondary flakes, 45 tertiary flakes, eight pieces of shatter, and 12 tested cobbles. The basalt artifacts include two secondary flakes, and four tertiary flakes. The chalcedony artifact is a tested cobble and the chert artifact is a secondary flake.

Those artifacts identified outside of the designated loci (70 items) include: three jasper cores (one bifacial, one unidirectional, and one multi-directional; Artifact Nos. 1, 6, and 8, four tested cobbles (three jasper and one chalcedony), and 63 jasper flakes (24 primary flakes, 13 secondary flakes, and 26 tertiary flakes). Loci descriptions are provided below.

Locus 1 is located along the extreme northeastern site boundary, measures 3.0 meters north to south by 1.6 meters east to west, and contains one bifacial core (Artifact No. 2;

broken into two pieces), one primary flake, five secondary flakes, five tertiary flakes, and one piece of shatter – all of red jasper.

Locus 2 is located within the southeastern site area approximately 48 meters south of Locus 1, measures 2.9 meters north to south by 1.3 meters east to west, and contains one primary flake, two secondary flakes, and one tested cobble – all of red jasper.

Locus 3 is also located within the southeastern site area approximately 14.5 meters southwest of Locus 2, measures 2.0 meters north to south by 1.3 meters east to west, and contains two primary flakes, three secondary flakes, and one tertiary flake – all of red jasper.

Locus 4 is also situated within the southeastern site area approximately 13 meters north northeast of Locus 3 and 12 meters northwest of Locus 2, measures 1.1 meters north to south by 1.8 meters east to west, and contains one unidirectional core (Artifact No. 3), one primary flake, three secondary flakes, one tertiary flake, and one tested cobble – all of red jasper.

Locus 5 is located within the central site area along the northern edge of a desert pavement surface approximately 34 meters west northwest of Locus 4, measures 1.6 meters north to south by 1.8 meters east to west, and contains one multi-directional core (Artifact No. 4), three primary flakes, one secondary flake, four tertiary flakes, and one tested cobble – all of red jasper.

Locus 6 is also located within the central site area approximately 12 meters due west of Locus 5, measures 11.2 meters north to south by a maximum of 6.3 meters east to west, and contains one bifacial core (Artifact No. 5), two primary flakes, 13 secondary flakes, two tertiary flakes, and two tested cobbles – all of red jasper.

Locus 7 is located within the western portion of the site approximately 18 meters west of Locus 6, measures 13.0 meters north to south by 10.2 meters east to west, and contains one bifacial core (Artifact No. 7), 14 primary flakes, seven secondary flakes, and two tested cobbles, all of red jasper, as well as two secondary, four tertiary flakes, and one tested cobble of basalt.

Locus 8 is located near the western site boundary approximately 24 meters west of Locus 7, measures 5.8 meters north to south by 10.8 meters east to west, and contains six primary flakes, 14 secondary flakes, eight tertiary flakes, and three pieces of shatter, all of red jasper, as well as one secondary chert flake.

Locus 9 is located along the extreme western site boundary approximately 26 meters southwest of Locus 8, measures 2.4 meters north to south by 1.2 meters east to west, and contains seven primary flakes, five secondary flakes, four tertiary flakes, and four pieces of shatter – all of red jasper.

The potential for buried artifacts is low as geologic sources indicate the fan remnant dates to the Early-to- Middle Pleistocene (Rogers 1967); however, artifacts associated with the surface pavement may be covered by eolian sands in limited areas (less than five percent) of the site. However, considering the artifact assemblage identified on site, which consists of cores, tested cobbles, and a large percentage of cortical debitage/shatter (127 of 183 debitage items, or 68%), all of which are indicative of early stage lithic reduction activities, it is highly likely that any artifacts present in subsurface contexts would mirror those artifact types already identified.

Based upon the cultural constituents and the physical context, archaeologists for the Applicant interpret this site as a lithic procurement and early stage lithic reduction locality. The lithic materials appear to be derived from cobbles of toolstone quality found on site within the desert pavement surfaces. The artifact types identified (unidirectional, multi-directional, and bifacial cores, tested cobbles, and a preponderance of cortical debitage) reflect initial lithic reduction activities. Such artifacts indicate percussion (hardhammer and/or soft-hammer) reduction (Andrefsky Jr. 2008; Odell 2004; Whittaker 1994). Additionally, all nine loci identified comprised primarily only one type of lithic material (jasper), and are interpreted as single reduction loci. Thus, the site appears to represent a minimum of nine episodes or localities of initial lithic reduction.

Because this site lacks artifacts with unique or temporally diagnostic characteristics, the material remains cannot be associated with a specific period of prehistory or ethnohistory. Additionally, this site cannot reliably be associated with any distinctive or significant event, person, design, or construction. Analysis of artifact distribution has been accounted for during the recordation process. As noted above, CA-SBR- 13071 is situated on a gently sloping toe slope of an erosional fan remnant, moderate- to well-developed desert pavement covers approximately 70% of the site, and eight of the nine loci. Most artifacts tend to be located in areas where desert pavement is present. The potential for buried artifacts is low as geologic sources indicate the fan remnant dates to the Early-to-Middle Pleistocene (Rogers 1967), prior to human presence in the area. Artifacts associated with the surface pavement may be covered by eolian sands in limited areas (less than five percent) of the site; however, it is highly likely that any artifacts present in subsurface contexts would mirror those artifact types already identified. Therefore, the data potential is considered exhausted through recordation of CA-SBR-13071.

CA-SBR-13073

CA-SBR-13073 is an oblong-shaped, complex lithic scatter that covers a total surface area of 884 square meters. The site is located within the central portion of the Phase 2 area of the Calico Solar Project site. The site is located at the intersection of the basin floor and the toe slope of the alluvial fan piedmont issuing from the Cady Mountains north of the Project site. West trending, slightly incised channels transect the area approximately 100 meters north and south of the site; the axial channel for the valley is located 375 meters west. Site sediments are silty fine to medium grain alluvial sand. The alluvial fan piedmont rises to the northeast, north, and east of the site. Vegetation in the site area and vicinity is dominated by the Creosote Bush Community which is characteristic of the Mojave Desert where rainfall is less than 19 centimeters annually. Within the site area, observed vegetation includes creosote bush (*Larrea tridentata*), burrobush (*Ambrosia dumosa*), and desert saltbush (*Artiplex polycarpa*), as well as bunch grasses that were unidentifiable during the archaeological survey. One dead teddy bear cholla (*Opuntia bigelovii*) is also present on site.

This complex lithic scatter measures 26 meters north to south by 50 meters east to west, and contains a total of 37 prehistoric artifacts (one complete biface, three biface fragments, one edge-modified flake tool, and 32 debitage items), the majority of which (30 items) are concentrated within the central and eastern site area designated as Locus 1. Artifact density at CA-SBR-13073 is moderate, with a calculated distribution of one artifact per 23.9 square meters. The overall condition of the site is good, with no visible alterations.

Locus 1 is located within the central and eastern site area, and measures 16.0 meters north to south by 27.5 meters east to west. Artifacts identified within Locus 1 include: one complete chalcedony biface, two chalcedony biface fragments, one unifacially edge-modified chalcedony flake tool, 25 pieces of chalcedony debitage (22 tertiary flakes, one secondary flake, and two pieces of shatter), and one jasper tertiary flake.

Those artifacts observed within 30 meters and outside of the locus consist of one chalcedony biface fragment, four jasper flakes (one secondary flake and three tertiary flakes), and two chalcedony flakes (one secondary and one tertiary).

The potential for buried artifacts at CA-SBR-13073 is high, as sheet wash and eolian reworking of surface sediments may have buried portions of the site. These lower energy processes may have preserved features or intact surfaces as well.

Based upon the cultural constituents, archaeologists for the Applicant interpret this complex lithic scatter as an early-to-late stage biface reduction locality. The cultural constituents of this site consist primarily of complete and broken chalcedony bifaces, and chalcedony tertiary flakes. Because the majority of lithic materials found within this complex lithic scatter are of the same primary stone material (chalcedony) that is a constituent with material in the surrounding area, the site appears to represent one single episode or locality of early-to-late stage biface reduction.

Although the surface manifestation of this site lacks artifacts with unique or temporally diagnostic characteristics that can be associated with a specific period or prehistory of ethnohistory, there is a high potential for subsurface archaeological deposits within the site area. Because of that potential for subsurface archaeological deposits at CA-SBR-13073, it is recommended that additional limited subsurface testing and artifact analysis be conducted in order to ascertain whether such deposits are present within the site area before the final determination of eligibility can be made. The limited test should be designed to evaluate: (1) the presence of subsurface artifacts or features; (2) the presence of temporally diagnostic artifacts or datable material such as obsidian or charcoal; (3) the integrity of any buried cultural deposits; and (4) the diversity of artifacts that could contribute information about lithic reduction activities at this location.

CA-SBR-13078

CA-SBR-13073 is an amorphous-shaped, moderate density lithic reduction that covers a total surface area of 1,358 square meters. The site is located within the central portion of the Phase 2 area of the Calico Solar Project site, and is situated near the toe slope of an erosional fan remnant and alluvial flat developed along the southern side of the axial channel for the valley. The site surface slopes gently (3 to 5 degrees) with a northwestern aspect. Medium to course sub-angular grains of sand and small pebbles moderately cover the surface suggesting wind erosion is actively affecting the surface by removing the finer fraction of the sediment. Site sediments consist of unconsolidated fine to medium grained alluvial sand. Limited eolian deposits consist of small coppice dunes and cover roughly 10% of the site. The west trending axial channel for the valley is 230 meters north of the site. The erosional fan remnant, which consists of low desert pavement covered hills containing pebbles and cobbles of toolstone quality materials (e.g., cryptocrystalline silicates), rises and extends to the south. Shallow northwest trending gullies draining the fan remnant pass 100 meters east and west of the site. Vegetation in the site area and vicinity is dominated by the Creosote Bush Community, which is characteristic of the Mojave Desert where rainfall is less than 19 centimeters annually. Within the site area, observed vegetation includes creosote bush (*Larrea tridentata*), burrobush (*Ambrosia dumosa*), and desert saltbush (*Artiplex polycarpa*), as well as bunch grasses that were unidentifiable during the archaeological survey.

This moderate density lithic reduction scatter measures 80 meters east to west by 25 meters north to south, and contains a total of 64 prehistoric artifacts (all debitage items). The majority of the debitage (41 items, or 64%) are concentrated within the western site area, within an area designated as Locus 1.

Artifact density at CA-SBR-13078 is moderate, with a calculated distribution of one artifact per 20.3 square meters. The overall condition of the site is good with no visible alterations.

Locus 1 is located within the western site area, and measures 13.8 meters east to west by 12.0 meters north to south. Artifacts identified within Locus 1 include five chalcedony secondary flakes, 31 chalcedony tertiary flakes, and five tertiary flakes of red jasper.

Those artifacts observed within 30 meters and outside of the locus include two secondary and 16 tertiary flakes of chalcedony, and five tertiary flakes of yellow/brown jasper.

The potential for buried artifacts at CA-SBR-13078 is low as geologic sources indicate the fan remnant dates to the Early-to-Middle Pleistocene (Rogers 1967); however, artifacts associated with the surface may be covered by eolian sands within limited portions of the site area.

Based upon the cultural constituents, archaeologists for the Applicant interpret this sparse lithic reduction scatter as an early-to-late stage biface reduction locality. The cultural constituents of this site include 67 flakes, the vast majority of which (60 items, or 89.6%) are tertiary flakes indicative of early-to-late stage biface reduction. Because the majority of lithic materials found within this lithic reduction scatter are of the same stone materials (chalcedony and jasper) that are constituents of the erosional fan remnant rising to the south of the site area, the site appears to represent one single episode or locality of early-to-late stage biface reduction. The lack of bifaces on site suggests that once produced, these tools/cores were carried off site.

The surface manifestation of this site lacks artifacts with unique or temporally diagnostic characteristics that can be associated with a specific period of prehistory or ethnohistory. Additionally, the potential for buried artifacts is low as geologic sources indicate the fan remnant dates to the Early-to-Middle Pleistocene (Rogers 1967), prior to human presence in the area. Artifacts associated with the surface scatter may be covered by eolian sands in limited areas (approximately 10%) of the site. However, considering the identified artifact assemblage consists only of lithic debitage items (primarily tertiary flakes indicative of early-to-late stage biface reduction), it is highly likely that any artifacts present in subsurface contexts would mirror those artifact types already identified. Therefore, the data potential is considered exhausted through recordation of CA-SBR-13078.

CA-SBR-13082

CA-SBR-13082 is an amorphous-shaped sparse density lithic reduction scatter that also contains two rock cluster features of unknown function and age. The site covers a total surface area of 3,098 square meters within the central portion of the Phase 2 area of the Calico Solar Project site. The site is situated on the summit of a north northwest trending ridge that is part of an older erosional fan remnant. The surface is nearly level in the central portion of the site and slopes moderately steeply (10 degree slope) to the east and west. The entire site surface is covered by a moderate- to well-developed desert pavement consisting of poorly sorted sub-angular to subround pebbles and cobbles of cryptocrystalline silicates (e.g., jasper, chert, and chalcedony), basalt, and other volcanic materials. All loci and artifacts are located in areas where desert pavement is present. East of the site, a rilled surface slopes down to the axial channel for the valley, and west of the site moderately incised gullies cut the slope and divide the area into several sub-ridges, which are also covered by a moderate- to well-developed desert pavement. Limited eolian deposits, consisting of minor accumulations of sand around the base of vegetation, covers less than two percent of the site. The axial channel for the valley is located 200 meters east of the site and 400 meters north of the site as it curves around the base of the ridge. The erosional fan remnant continues west and south broken by inset fans associated with a major north trending drainage. Vegetation in the site area and vicinity is dominated by the Creosote Bush Community which is characteristic of the Mojave Desert where rainfall is less than 19 centimeters annually. Within the site area, observed vegetation includes creosote bush (*Larrea tridentata*).

This sparse density lithic reduction scatter measures 160 meters north northwest to south southeast by a maximum of 31 meters east to west, and contains a total of 96 prehistoric artifacts. Artifact density is low, with a calculated distribution of one artifact per 32.3 square meters. However, two discrete loci with higher concentrations of cultural materials do occur within the site area. The overall condition of this site is good with no alterations.

The major physical surface characteristic of this site is a lithic reduction scatter containing approximately 96 cryptocrystalline silicate (jasper and chert) artifacts, including 86 pieces of lithic debitage, eight cores, and two tested cobbles. Two rock cluster features (i.e., Features 1 and 2) of unknown age and function were also identified on site. Of the 96 artifacts and two features identified, 48 pieces of debitage, four cores, and Feature 2 occur within two discrete loci (i.e., Loci 1 and 2) with higher concentrations of artifacts; the remainder of the cultural materials identified (38 pieces of debitage, four cores, and two tested cobbles) and Feature 1 (which serves as site datum) occur outside of these designated loci.

Locus 1 is located in the northeastern portion of the site, measures approximately 15 meters north to south by 8.7 meters east to west, and contains three multi-directional cores, one bifacial core, 28 primary flakes, three secondary, and two tertiary flakes, all of jasper.

Locus 2 is located along the central-western site boundary approximately 30 meters southwest of Locus 1, measures 5.8 meters east to west by 3.9 meters north to south, and contains 15 pieces of jasper debitage (two primary flakes, nine secondary flakes, one tertiary flake, and three pieces of shatter).

Cultural materials identified outside of Loci 1 and 2, within the general site area (44 items) include: two unidirectional jasper cores, two multi-directional jasper cores, two tested jasper cobbles, 33 jasper debitage items (18 primary flakes, six secondary flakes, five tertiary flakes, and four pieces of shatter), and five debitage items of chert (two primary flakes, two secondary flakes, and one piece of shatter).

As noted above, two rock cluster features of unknown function and age were also identified on site. Feature 1 is located within a non-locus site area near the central-western site boundary, measures 1.86 meters east to west by 2.0 meters north to south and 0.37 meters in height, and is constructed of one to two courses of metavolcanic rocks ranging from approximately 5.0 to 28 centimeters in diameter. Feature 2 is located in the northeastern site area along the central-western boundary of Locus 1, measures approximately 0.75 meters in diameter and 0.27 meters high, and is also constructed of one to two courses of metavolcanic rocks ranging from 4.0 to 26 centimeters in diameter. None of the rocks comprising Features 1 and 2 are fire-altered, and no charcoal or other organic residues were noted in association with these features.

The potential for buried artifacts at CA-SBR-13082 is low, as geological sources indicate the fan remnant dates to the early-to-middle Pleistocene, and minor eolian deposits consisting of small coppice dunes cover less than two percent of the site area.

Based upon the cultural constituents and the physical context, archaeologists for the Applicant interpret this site as a sparse density lithic procurement and initial lithic reduction locality. The lithic materials appear to be derived from cobbles of toolstone quality found on site within the desert pavement surfaces, and the artifact types identified (unidirectional, multi-directional, and bifacial cores, tested cobbles, and a preponderance of cortical debitage) reflect initial lithic reduction activities. Such artifacts indicate percussion (hard-hammer and/or soft-hammer) reduction (Andrefsky Jr. 2008; Odell 2004; Whittaker 1994). Additionally, both loci identified include only one type of lithic material (jasper), and are interpreted as single reduction loci. Thus, the site appears to represent a minimum of two episodes or localities of initial lithic reduction. The age and function of the two rock cluster features identified remains undetermined; however, none of the metavolcanic rocks that constitute Features 1 and 2 are fire-altered, and no charcoal or other organic residues were noted in association with these features.

Because this site lacks artifacts with unique or temporally diagnostic characteristics, the material remains cannot be associated with any specific period of prehistory or ethnohistory. Additionally, this site cannot reliably be associated with any distinctive or significant event, person, design, or construction, and the artifact distribution has been documented during the recordation process. As noted above, CA-SBR-13082 is situated on the summit of a north northwest trending ridge that is part of an older erosional fan remnant. The entire site surface is covered by a moderate- to well-developed desert pavement, and all loci and artifacts are located in areas where desert pavement is present. The potential for buried artifacts is low, as geologic sources indicate the fan remnant dates to the early-to-middle Pleistocene, prior to human presence in the area. Artifacts associated with the surface pavement may be covered by eolian sands in limited areas (less than two percent) of the site. However, considering the artifact assemblage identified on site which consists cores, tested cobbles, and a large percentage of cortical debitage (79% of the debitage identified), all of which are indicative of initial lithic reduction activities, it is highly likely that any artifacts present in subsurface contexts would mirror those artifact types already identified. Therefore, the data potential is considered exhausted through recordation of CA-SBR-13082.

CA-SBR-13096

CA-SBR-13096, a sparse, amorphous-shaped prehistoric lithic reduction scatter covers a total surface area of 200 square meters near the extreme southwestern corner of the Phase 1 area of the Calico Solar Project site. The site is situated on a nearly level (less than 1 degree slope), southwest-facing rise on a fan skirt in the lower alluvial fan piedmont between two gullies merging with the basin floor; the gullies are located approximately 200 meters east and west of the site, and the axial channel for the basin is located 380 meters south. The alluvial fan piedmont is the large, gently sloping depositional feature that dominates the northern portion of the Calico Solar Project site; commonly referred to as a "bajada." As a whole, this appears to be a much younger landform than those in the southern portion of the Calico Solar Project site. The general area around the site is fairly stable and shows little evidence of major fluvial erosion. Site sediments are fine- to medium-grained sand with few small sub-rounded pebbles. Surface sediments have been slightly reworked by wind, and minor accumulations of sand occur at the base of some vegetation. An older erosional remnant fan, which consists of a series of ridges covered by a well developed desert pavement, is located south of the axial channel, and an alluvial flat is located approximately 1,000 meters west; the slope grades upward into the alluvial piedmont to the north and east. Vegetation in the site area and vicinity is dominated by the Creosote Bush Community which is characteristic of the Mojave Desert where rainfall is less than 19 centimeters annually. Within the site area, observed vegetation includes creosote bush (*Larrea tridentata*), burrobush (*Ambrosia dumosa*), and desert saltbush (*Artiplex polycarpa*), as well as bunch grasses that were unidentifiable during the archaeological survey.

This high density lithic reduction scatter measures 36 meters north to south by 17 meters east to west, and contains a total of 16 lithic debitage items of chalcedony, jasper, and chert; no formed tools, discrete concentrations of cultural materials, or features were identified. Artifact density is high within the site area (one item per 12 square meters). The overall condition of the site is good, with no visible disturbances or alterations.

As noted above, this lithic reduction scatter contains 16 lithic debitage items of chalcedony, jasper, and chert. Artifacts observed include one chalcedony secondary flake, 11 chalcedony tertiary flakes, and two pieces of chalcedony shatter. The remaining two artifacts include one secondary flake of red jasper and one secondary flake of chert.

The potential for buried artifacts at the site is moderate to high, and buried features or surfaces may be intact as sheet wash and other low energy forms of deposition are common on the lower portions of the alluvial fan piedmont.

Based upon the cultural constituents, archaeologists for the Applicant interpret this moderate to high density lithic reduction scatter as an early-to-late stage biface reduction or tool maintenance locality. The prehistoric cultural assemblage is dominated by non-cortical tertiary flakes indicative of the various stages of biface reduction or tool maintenance activities. The limited quantity of artifacts and the dominance of chalcedony debitage (87.5 percent of the assemblage) suggest that the cultural assemblage is the result of one short term episode of early-to-late stage biface reduction or tool maintenance.

Additionally, due to the absence of any finished tools, bifacial cores, or preforms on site, it is probable that any finished tools produced on site were carried to an off site location.

Although the surface manifestation of this site lacks artifacts with unique or temporally diagnostic characteristics that can be associated with any specific period of prehistory or ethnohistory, there is a high potential for subsurface archaeological deposits within the site area. There is potential for subsurface archaeological deposits at CA-SBR-13096.

CA-SBR-13125/H

CA-SBR-13125/H is an amorphous-shaped low density multiple activity area that covers a total surface area of 2,828 square meters. The site is located near the extreme western end of the Phase 2 area of the Calico Solar Project site, and is situated on a nearly level (1 degree slope) relict alluvial flat, which dominates the general area. The relict alluvial flat landform dominates the western part of the southern portion of the Calico Solar Project site, and can be distinguished from other relict landforms in the southern area by a nearly flat, low lying surface that is cut by numerous braided and anastomatizing channels/gullies. These channels are dominantly oriented in the same direction as the major east-west trending axial channel that transects the Calico Solar Project area. Between these small channels/gullies tend to be bars of intact desert pavement (indicating a relative antiquity for the landform and thus use of the term “relict”). A braided series of west trending channels transect the southern portion of the site, as well as the area immediately south. A braided series of west trending channels transect the southern portion of the site, as well as the area immediately south. Moderate-developed desert pavement made up of sub-angular to sub-rounded pebbles and a few small cobbles covers most of the site area. Limited eolian deposits consisting of small coppice dunes cover less then 10% of the site. West of the site, the landform transitions into a more recent alluvial flat with less developed desert pavement. The axial channel for the valley is splayed across most of the valley floor as a complex network of braided channels.

Vegetation in the site area and vicinity is dominated by the Creosote Bush Community which is characteristic of the Mojave Desert where rainfall is less than 19 centimeters annually. Within the site area, observed vegetation includes creosote bush (*Larrea tridentata*), burrobush (*Ambrosia dumosa*), and desert saltbush (*Artiplex polycarpa*), as well as bunch grasses that were unidentifiable during the archaeological survey. Most of the dense vegetation is growing within the braided series of west trending channels that transect the southern portion of the site, as well as the area to the immediate south.

This multiple activity area measures 122 meters east to west by a maximum of 52 meters north to south, and contains both a sparse prehistoric lithic reduction scatter and a sparse historical refuse scatter. No discrete concentrations of prehistoric or historical materials or features were identified, and artifact density is low within the site area (one item per 64.2 square meters). The overall condition of the site is good, with no visible alterations.

The prehistoric component consists of a sparse lithic reduction scatter that includes 17 flakes (seven jasper, five chert, and five chalcedony) scattered widely throughout the site area. The debitage assemblage is dominated by tertiary biface thinning flakes; only one secondary flake of jasper was observed. Several of the chert flakes exhibit a lustrous, waxy texture suggestive of heat treatment.

The historical refuse observed is also scattered widely throughout the site area, appears to date from the early-to-middle 1900s, and includes various types of metal cans (12), fragments of highly weathered milled lumber (12), and iron straps (three). Can types include: three church key opened (post-1935: IMACS User's Guide 2001:471-6) beverage cans, six single-serving-sized sanitary foods cans (post 1904: IMACS User's Guide 2001:471-6; Fike 1989:22), both rotary and bayonet opened, two one-pound dry goods cans with external friction lids, and one rectangular spice can lid. The further character of the historical artifacts found within CA-SBR-13125/H is unreported.

The potential for buried artifacts at CA-SBR-13125/H is moderate due to the age of the landform; however, reworking of the local sediments by the wash suggests that buried artifacts are in secondary disturbed context and the likelihood of finding intact surfaces or features is low. Artifacts associated with the surface pavement may be covered by eolian sands in very limited portions of the site.

Based upon the cultural constituents, archaeologists for the Applicant interpret the prehistoric component of the site as a sparse density early-to-late stage biface reduction locality. The prehistoric cultural constituents consist 17 flakes of jasper, chert, and chalcedony. This debitage assemblage is dominated by tertiary biface thinning flakes; only one secondary flake of jasper was identified. Several of the chert flakes exhibit a lustrous, waxy texture suggestive of the heat treatment of these materials. However, because the debitage consists of a variety of cryptocrystalline silicate materials and the flakes are so widely scattered throughout the site area, it remains undetermined whether the debitage is the result of one or more episodes of early-to-late stage biface reduction. Additionally, due to the absence of complete or broken bifaces on site, it should not be discounted that artifacts within this locality may have been collected and used elsewhere.

The historical refuse scatter identified on site appears to date from the early-to-middle 1900s, and includes: three church key opened beverage cans, six single-serving-sized sanitary foods cans (both rotary and bayonet opened), two one-pound dry goods cans with external friction lids, one rectangular spice can lid, 12 fragments of highly weathered milled lumber, and three iron straps. The further character of the historical artifacts found within CA-SBR-13125/H is unreported. Church key opened cans date from 1935 and thereafter (IMACS User's Guide 2001:471-6). Sanitary cans were first mass-produced by the Sanitary Can Company in 1904, and in 1908 the American Can Company purchased and took over the four Sanitary Can Company manufacturing plants (IMACS User's Guide 2001:471-6). Sanitary can production dominated can production in the western United States by 1911, but it took nearly 30 more years for it to gain complete control (Fike 1989:22).

Due to the close proximity of the Old National Trails Highway to CA-SBR-13125/H and the fact that the historical refuse is widely scattered throughout the site area, the archaeologists for the Applicant believe that the historical refuse is the result numerous random episodes of refuse disposal associated with use of the Old National Trails Highway during the early-to-middle 1900s. Conceivably, many of these items (particularly the cans) may also have been re-deposited from their primary disposal location and dispersed throughout the site area by water or high winds.

LSA disagrees with the statement by the consultant for the applicant that "The surface manifestation of this site lacks artifacts with unique or temporally diagnostic characteristics that can be associated with a specific period of prehistory or history, The potential for buried artifacts at this site is moderate due to the age of the landform, the reworking of the local sediments by the wash suggests that buried artifacts will be in secondary disturbed context, and the likelihood of finding intact surfaces or features is low. Artifacts associated with the surface pavement may be covered by eolian sands in limited portions (less than 10%) of the site; however, it is highly likely that any artifacts buried within these coppice dunes would mirror those artifact types already identified. Therefore, the data potential is considered exhausted through recordation of CA-SBR-13125/H."

CA-SBR-13349/H

In October 2009, archaeological site CA-SBR-13108/H was re-examined as part of the Calico Solar Project. Additional artifacts were discovered between this site and CA-SBR-13087, -13109, -13110, -13112, P-36-014803, P-36-014854, and P-36014857. As a result of the survey, these sites were combined to form combined site CA-SBR-13349/H. CA-SBR-13108 was originally described as a multi-component site measuring 356 meters north to south by 440 meters east to west. The prehistoric component contained 208 cryptocrystalline silicate and metavolcanic artifacts including primary, secondary, and tertiary flakes and cores, core tools, a flake tool, and a biface fragment. The historical component contained approximately 1,000 artifacts including bottle glass, cans, ceramic tableware, and construction items. CASBR-13087 was originally described as a discrete prehistoric lithic scatter, measuring 25 meters north to south by 9.0 meters east to west, containing six jasper primary and secondary flakes. CA-SBR-13109 was originally described as a prehistoric site, measuring 56 meters north to south and 129 meters east to west, containing 27 jasper and basalt artifacts (flakes, a bifacial tool, a core tool, and a metate fragment). CA-SBR-13110 was originally described as a discrete prehistoric lithic scatter, measuring 24 meters north to south and 12 meters east to west, containing 11 chert and chalcedony flakes. CA-SBR-13112 was originally described as a discrete prehistoric lithic scatter, measuring 84 meters north to south and 40 meters east to west, containing 15 jasper flakes and one metavolcanic utilized flake. P-36-014803 was originally described as an isolate consisting of one brown cryptocrystalline silicate flake. P-36-014854 was originally described as an isolate consisting of two jasper flakes, one chalcedony flake, and one jasper core. P-36-014857 was originally described as an isolate consisting of five red cryptocrystalline silicate flakes.

Combined Site CA-SBR-13349/H is an amorphous-shaped multiple activity area that covers a total surface area of 147,855 square meters. The site is located within the southwestern portion of the Phase 2 area of the Calico Solar Project site. The site is situated on a nearly level erosional fan remnant. The erosional fan remnant constitutes the hills and ridges that extend above, and are surrounded by, the other landforms in the southern portion of the Calico Solar Project area. They generally are composed of a summit with moderately- to well-developed desert pavement (due to both parent material and age) and erosional side slopes that generally lack pavement. Within the southern Project area, these fan remnants are generally composed of a very old (Early-to-Middle Pleistocene) fanglomerate of cobbles and coarse gravels. The slope is one to two percent and faces east. The site surface is covered by a moderate- to well-developed desert pavement consisting of poorly sorted sub-angular to sub-rounded pebbles and cobbles of cryptocrystalline silicates (e.g., jasper, chert, and chalcedony), basalt, and other volcanic materials. Bar and swale surface morphology is common throughout the site and is recognized as a series of alternating elongate low mounds of coarser material separated by elongate shallow depressions of finer material. This landscape type is typically the result of mass wasting during the formation of a fan remnant rather than erosional bar and channel topography common in washes. The continuity of the pavement is broken by small west trending gullies and small drainage features. Limited eolian deposits consist of small coppice dunes and in-filled gullies that cover less than eight percent of the site. Site sediments generally consist of fine to medium grained sand with poorly sorted sub-rounded to subangular pebbles and cobbles. A small braided wash in the northern portion of the site forms one of the upper branches of the axial channel for the valley. The remnant fan that the site rests upon extends east and west for several hundred meters in both directions. The Pisgah lava flow is evident 100 meters to the south, although an isolated lava mass is located within the site boundaries, and isolated boulders from this formation are scattered throughout the site area. At the base of the lava flow, a narrow sand sheet is evident.

Vegetation in the site area and vicinity is dominated by the Creosote Bush Community which is characteristic of the Mojave Desert where rainfall is less than 19 centimeters annually. Within the site area, observed vegetation includes creosote bush (*Larrea tridentata*) and desert saltbush (*Artiplex polycarpa*).

This multiple activity area measures 495 meters northwest to southeast by 915 meters northeast to southwest, and contains both a prehistoric complex lithic and ground stone scatter and a historical refuse scatter. This multi-component site contains a total of 1,985 prehistoric and historical artifacts, five historical features, and 49 loci where higher concentrations of prehistoric artifacts were identified; artifact density is low within the site area (one artifact per 75 square meters). The overall condition of the site is fair, with off-highway vehicle (OHV) activity observed in the surrounding area, as well as evidence of bulldozing activity on the eastern portion of the site for electrical tower access roads.

The prehistoric component is a complex lithic and ground stone scatter with a total of 1,333 artifacts. Artifacts include: 848 jasper flakes (183 primary, 372 secondary, 136 tertiary, 105 shatter, and 52 unreported type), 409 cryptocrystalline silicate flakes (77 primary, 196 secondary, 68 tertiary, 67 shatter, and one unreported type), 15 chalcedony flakes (two primary, eight secondary, three tertiary, and two unreported), 24 chert flakes (five primary, seven secondary, two tertiary, and 10 unreported), four basalt flakes (one primary, two tertiary, and one shatter), 16 cores (jasper and cryptocrystalline silicate), five bifaces (jasper and cryptocrystalline silicate), two jasper edge modified flakes, one jasper flake tool, one granitic basalt metate, and eight tested cobbles. The prehistoric component also contains 41 areas with a higher concentration of artifacts (Loci 7, 9-25, and 27-49). Nearly 74% of prehistoric artifacts (or 984 prehistoric items) are within the loci.

The historical component is a widespread refuse scatter composed of a minimum of 652 artifacts, including bottle and jar glass fragments, ceramic tableware fragments, various food and beverage cans, various paint and oil cans, machine and automobile parts, miscellaneous metal items (i.e., wire, banding, mesh), and construction debris (i.e., concrete, brick, lumber, asphalt). The historical component also contains eight areas with a higher concentration of artifacts (Loci 1-6, 8, 26) and seven features. Both loci and features are described below.

Feature 1 is located within the central-southern portion of the site, measures 4 inches by 4 inches by 5 feet tall, and consists of a single wood fencepost with a rock base.

Feature 2 is located within the central portion of the site, approximately 140 meters north of Feature 1. Feature 2 measures roughly 50 feet in diameter, and consists of a circular rock feature constructed of approximately 500 stones. The phrase “Pisgah 2077-30” is spelled out in stones within the feature.

Feature 3 is located within the central portion of the site, approximately 6.0 meters west of Feature 2. Feature 3 is a metal windsock stand measuring approximately 20 feet tall and constructed of two-inch metal tubing. The base of the windsock is composed of wood with a wire tie down.

Feature 4 is located within the northeastern portion of the site, approximately 350 meters northeast of Feature 3. Feature 3 measures 18 inches north to south by 31 inches east to west and 8 inches high, and consists of a rock cluster composed of six small to large metavolcanic boulders. The boulders are arbitrarily placed in a cluster, revealing no apparent form.

Feature 5 is located along the eastern site boundary, approximately 100 meters south of Feature 4. Feature 5 measures 17.5 inches north to south by 19.5 inches east to west and 6.25 inches high, and consists of a rock cluster composed of 15 metavolcanic and basalt angular and rounded cobbles.

Feature 6 is located along the eastern site boundary, approximately 2.0 meters north of Feature 5. Feature 6 measures approximately 45 feet northeast to southwest by 33 feet northwest to southeast and consists of a concrete pad with metal bolts along the sides.

Feature 7 is located within the western portion of the site, approximately 568 meters southwest of Feature 6. Feature 6 was not measured and consists of a rock cluster composed of approximately 20 metavolcanic cobbles.

Of the 1,985 prehistoric and historical artifacts identified, 1150 artifacts occur within 49 discrete loci (i.e., Loci 1-49) with higher concentrations of artifacts situated on moderate-developed desert pavement surfaces; the remaining cultural materials identified occur outside of these designated loci.

Locus 1 is located within the southern portion of the site, measures 61 meters north to south by 24 meters east to west, and contains a minimum of 29 historical artifacts, including: metal items (wire, pipe, 1/2" braided cable, mattress springs, two 50 gallon drums, five gallon container, paint cans, fruit and juice cans, church key opened cans [post 1935: IMACS User's Guide 2001:471-6]), car items (metal oil filter, large rubber tire, rubber hose, gas tank, car frame, trunk door), railroad items (metal spike and square plate, wooden ties), wooden items (stakes, slats), construction debris (red ceramic tile, concrete, asphalt, red brick), and various brown and green glass bottle fragments; one with "I (in oval)" on the base (Owens Illinois Glass Co., since 1954: Toulouse 1971:403) and one with L" on the base (Latchford Glass Co., since 1957: Toulouse 1971:316).

Locus 2 is located within the southern portion of the site, approximately 3.0 meters west of Locus 1. Locus 2 measures 30 meters north to south by 18 meters east to west, and contains a minimum of six historical artifacts, including: lumber, glass, paint cans, chicken wire, a metal spool, and concrete.

Locus 3 is located within the central portion of the site, approximately 106 meters north of Locus 2. Locus 3 measures 6.5 meters north to south by 7.0 meters east to west, and contains a minimum of 31 historical artifacts, including: metal items (wire, banding, mesh, paint cans, approximately 25 hole-in-top cans and church key opened cans [post 1935: IMACS User's Guide 2001:471-6], ceramic tile, and a glass jar finish with lid fragment).

Locus 4 is located within the central portion of the site, approximately 30 meters north of Locus 3. Locus 4 measures 12 meters north to south by 45 meters east to west, and contains a minimum of 13 historical artifacts, including: a rock cairn (one course of basalt stones), metal items (wire, sheet metal, paint cans, paint thinner cans, mesh, drum lids), industrial ceramic artifact (hollow, square, and chambered), and colorless glass liquor bottle fragments.

Locus 5 is located within the central portion of the site, approximately 46 meters west of Locus 4. Locus 5 measures 5.0 meters north to south by 6.0 meters east to west, and contains a minimum of seven historical artifacts, including: metal items (banding, mesh, wire, paint cans, insulator), and ceramic piping and tile.

Locus 6 is also located along the central-western site boundary, approximately 43 meters southwest of Locus 5. Locus 6 measures 8.0 meters north to south by 13 meters east to west, and contains a minimum of 61 historical artifacts, including wire mesh and more than 60 fragments of red brick with “Davidson” on them.

Locus 7 is located within the central-northern portion of the site, approximately 74 meters northeast of Locus 6. Locus 7 measures 21 meters north to south by 44 meters east to west, and includes: 98 jasper flakes (38 primary, 35 secondary, three tertiary, and 22 shatter), six cryptocrystalline silicate flakes (one primary, four secondary, and one tertiary), and one chalcedony secondary flake.

Locus 8 is located within the northeastern portion of the site, approximately 270 meters northeast of Locus 7. Locus 8 measures 10 meters northeast to southwest by 5.0 meters northwest to southeast, and contains a minimum of 10 historical artifacts, including: metal items (wire, banding, cans, juice cans), automobile items (brake pads, metal oil cans, battery), brown and clear glass fragments, and several pieces of lumber (wooden two-by-fours).

Locus 9 is located along the northwestern site boundary, approximately 290 meters southwest of Locus 8. Locus 9 measures 2.0 meters north to south by 1.5 meters east to west, and includes 21 cryptocrystalline silicate flakes (four primary, 15 secondary, and two shatter).

Locus 10 is located within the western portion of the site, approximately 286 meters southwest of Locus 9. Locus 10 measures 2.5 meters north to south by 3.0 meters east to west, and includes seven jasper flakes (one primary, four secondary, and two shatter).

Locus 11 is located within the southern portion of the site, approximately 283 meters southeast of Locus 10. Locus 11 measures 1.0 meter north to south by 1.0 meter east to west, and includes five jasper flakes (unreported type).

Locus 12 is also located within the southern portion of the site, approximately 22 meters west of Locus 11. Locus 12 measures 18 meters northwest to southeast by 10.5 meters northeast to southwest, and includes: nine jasper flakes (seven secondary, one tertiary, and one shatter), 14 cryptocrystalline silicate flakes (one primary, nine secondary, three tertiary, and one shatter), and one cryptocrystalline silicate multi-directional core in two pieces.

Locus 13 is located along the southern site boundary, approximately 28 meters southwest of Locus 12. Locus 13 measures 9.0 meters northwest to southeast by 16.5 meters northeast to southwest, and includes: 26 jasper flakes (six primary, 14 secondary, and six tertiary), one tested metavolcanic cobble, and one unifacial core.

Locus 14 is located within the southern portion of the site, approximately 40 meters north of Locus 13. Locus 14 measures 3.0 meters northwest to southeast by 1.0 meter northeast to southwest, and includes: 17 cryptocrystalline silicate flakes (three primary, nine secondary, two tertiary, and three shatter) and three chalcedony flakes (one primary, one secondary, and one tertiary).

Locus 15 is located along the southern site boundary, approximately 38 meters southwest of Locus 14. Locus 15 measures 1.5 meters north to south by 2.0 meters east to west, and includes nine jasper flakes (four primary, two secondary, and three tertiary) and one jasper unifacial core.

Locus 16 is located within the southern portion of the site, approximately 36 meters northwest of Locus 15. Locus 16 measures 1.5 meters north to south by 1.5 meters east to west, and includes 10 jasper flakes (five primary, three secondary, one tertiary, and one shatter) and four cryptocrystalline silicate flakes (two primary and two secondary).

Locus 17 is located along the eastern site boundary, approximately 547 meters northeast of Locus 16. Locus 17 measures 2.0 meters north to south by 1.5 meters east to west, and includes six chert flakes (four secondary and two tertiary).

Locus 18 is located within the northern portion of the site, approximately 336 meters west of Locus 17. Locus 18 measures 5.0 meters north to south by 4.0 meters east to west, and includes 10 cryptocrystalline silicate flakes (one primary, seven secondary, and two tertiary), one jasper secondary flake, and one jasper biface preform.

Locus 19 is located along the northern site boundary, approximately 22 meters northeast of Locus 18. Locus 19 measures 2.0 meters north to south by 4.0 meters east to west, and includes 21 cryptocrystalline silicate flakes (three primary, 13 secondary, four tertiary, and one shatter) and one jasper primary flake.

Locus 20 is located within the northern portion of the site, approximately 39 meters southwest of Locus 19. Locus 20 measures 7.0 meters north to south by 6.5 meters east to west, and includes 11 jasper flakes (one primary, four secondary, four tertiary, and two shatter).

Locus 21 is located along the northern site boundary, approximately 38 meters northwest of Locus 20. Locus 21 measures 5.5 meters north to south by 3.5 meters east to west, and includes 13 jasper flakes (six primary, six secondary, and one tertiary).

Locus 22 is also located along the northern site boundary, approximately 10 meters west of Locus 21. Locus 22 measures 7.0 meters north to south by 3.5 meters east to west, and includes 20 jasper flakes (nine primary, eight secondary, one tertiary, and two shatter).

Locus 23 is located within the northern portion of the site, approximately 19 meters west of Locus 22. Locus 23 measures 7.5 meters north to south by 10.5 meters east to west, and includes nine jasper flakes (two primary, six secondary, and one shatter) and four cryptocrystalline silicate flakes (one primary, one secondary, one tertiary, and one shatter).

Locus 24 is located along the central-western portion of the site, approximately 178 meters southwest of Locus 23. Locus 24 measures 28 meters northwest to southeast by

28 meters northeast to southwest, and includes 25 jasper flakes (unreported type) and two jasper cores of unreported type.

Locus 25 is located along the northeastern site boundary, approximately 400 meters northeast of Locus 24. Locus 25 measures 9.0 meters northwest to southeast by 4.0 meters northeast to southwest, and includes 13 jasper flakes (one primary, 10 secondary, one tertiary, and one shatter), one cryptocrystalline silicate secondary flake, and one jasper multi-directional core (Artifact No.-6).

Locus 26 is located along the northern site boundary, approximately 82 meters northwest of Locus 25. Locus 26 measures 9.0 meters north to south by 13 meters east to west, and contains a minimum of 26 historical artifacts, including: a single row of six power pole planks (16 feet long by 10 inches diameter), a single-serve sanitary fruit/vegetable can (rotary opened), two 32 ounce multi-serve sanitary fruit/vegetable cans (rotary opened), a one pound dry goods external friction can, more than 20 fragments of colorless glass from a single jar with "Duraglas (in script)" on the heel (Owens Illinois Glass Co., since 1940: Toulouse 1971:170), and a colorless drinking glass with engraved pink and orange floral designs.

Locus 27 is located within the northern portion of the site, approximately 212 meters southwest of Locus 26. Locus 27 measures 1.5 meters north to south by 1.0 meter east to west, and includes seven jasper flakes (three primary and four shatter).

Locus 28 is located along the central-southern site boundary, approximately 280 meters southwest of Locus 27. Locus 28 measures 12 meters north to south by 8.0 meters east to west, and includes: 25 jasper flakes (five primary, 16 secondary, and four tertiary), four cryptocrystalline silicate flakes (two primary, one secondary, and one tertiary), and one jasper unifacial core in two pieces.

Locus 29 is located along the northeastern site boundary, approximately 490 meters northeast of Locus 28. Locus 29 measures 1.0 meter northwest to southeast by 3.0 meters northeast to southwest, and includes 11 cryptocrystalline silicate flakes (one primary, four secondary, two tertiary, and four shatter).

Locus 30 is located along the central-southern site boundary, approximately 460 meters southwest of Locus 29. Locus 30 measures 8.0 meters northwest to southeast by 12.5 meters northeast to southwest, and includes four jasper flakes (one secondary, two tertiary, and one shatter) and 39 ryptocrystalline silicate flakes (two primary, 18 secondary, 10 tertiary, and nine shatter).

Locus 31 is also located along the central-southern site boundary, approximately 10 meters northeast of Locus 30. Locus 31 measures 8.0 meters north to south by 4.5 meters east to west, and includes: 11 jasper flakes (one primary, four secondary, four tertiary, and two shatter), eight cryptocrystalline silicate flakes (four primary, three secondary, and one tertiary), and one cryptocrystalline silicate multidirectional core.

Locus 32 is also located along the central-southern site boundary, approximately 6.0 meters southeast of Locus 31. Locus 32 measures 4.5 meters north to south by 5.0

meters east to west, and includes 36 jasper flakes (five primary, 23 secondary, three tertiary, and five shatter).

Locus 33 is located within the southern portion of the site, approximately 22 meters north of Locus 32. Locus 33 measures 11.5 meters northwest to southeast by 4.5 meters northeast to southwest, and includes: 12 jasper flakes (one primary, seven secondary, and four tertiary), 11 cryptocrystalline silicate flakes (two primary, eight secondary, and one tertiary), and one jasper unifacial core.

Locus 34 is located within the central-southern portion of the site, approximately 10 meters north of Locus 33. Locus 34 measures 3.0 meters north to south by 2.0 meters east to west, and includes eight jasper flakes (one primary, six secondary, and one shatter) and eight chert flakes (five primary and three secondary).

Locus 35 is also located within the central-southern portion of the site, approximately 52 meters east of Locus 34. Locus 35 measures 2.0 meters north to south by 3.0 meters east to west, and includes 15 jasper flakes (two primary, nine secondary, two tertiary, and two shatter) and one jasper bifacial core.

Locus 36 is also located within the central-southern portion of the site, approximately 4.0 meters north of Locus 35. Locus 36 measures 3.0 meters northwest to southeast by 1.5 meters northeast to southwest, and includes 14 cryptocrystalline silicate flakes (one primary, six secondary, three tertiary, and four shatter).

Locus 37 is also located within the central-southern portion of the site, approximately 84 meters east of Locus 36. Locus 37 measures 6.0 meters northwest to southeast by 3.0 meters northeast to southwest, and includes 12 jasper flakes (seven primary, three secondary, and two shatter).

Locus 38 is located along the eastern site boundary, approximately 86 meters southeast of Locus 37. Locus 38 measures 6.0 meters northwest to southeast by 3.0 meters northeast to southwest, and includes 12 jasper flakes (one primary, seven secondary, one tertiary, and three shatter).

Locus 39 is located within the central portion of the site, approximately 194 meters northwest of Locus 38. Locus 39 measures 3.0 meters north to south by 3.0 meters east to west, and includes 11 jasper flakes (one primary, six secondary, two tertiary, and two shatter) and one cryptocrystalline silicate primary flake.

Locus 40 is also located within the central portion of the site, approximately 20 meters southwest of Locus 39. Locus 40 has unreported dimensions, and includes 11 jasper flakes (four primary, four secondary, and three tertiary).

Locus 41 is also located within the central portion of the site, approximately 35 meters northwest of Locus 40. Locus 41 measures 4.0 meters north to south by 4.0 meters east to west, and includes 11 cryptocrystalline silicate flakes (three primary, four secondary, three tertiary, and one shatter) and one piece of jasper shatter.

Locus 42 is also located within the central portion of the site, approximately 10 meters west of Locus 41. Locus 42 measures 2.5 meters north to south by 3.0 meters east to west, and includes 32 cryptocrystalline silicate flakes (four primary, 18 secondary, two tertiary, and eight shatter) and one cryptocrystalline silicate bifacial core.

Locus 43 is also located within the central portion of the site, approximately 20 meters west of Locus 42. Locus 43 measures 3.5 meters northwest to southeast by 11.5 meters northeast to southwest, and includes 52 cryptocrystalline silicate flakes (six primary, 18 secondary, four tertiary, and 24 shatter).

Locus 44 is also located within the central portion of the site, approximately 9.0 meters west of Locus 43. Locus 44 measures 3.0 meters north to south by 14.5 meters east to west, and includes 72 jasper flakes (10 primary, 33 secondary, 20 tertiary, and nine shatter) and 15 cryptocrystalline silicate flakes (two primary, six secondary, four tertiary, and three shatter).

Locus 45 is also located within the central portion of the site, approximately 17 meters northeast of Locus 44. Locus 45 measures 2.0 meters north to south by 2.0 meters east to west, and includes nine jasper flakes (two primary, three secondary, two tertiary, and two shatter).

Locus 46 is located within the central-southern portion of the site, approximately 72 meters southwest of Locus 45. Locus 46 measures 1.5 meters north to south by 1.5 meters east to west, and includes 16 cryptocrystalline silicate flakes (five primary, seven secondary, three tertiary, and one shatter).

Locus 47 is located along the southwestern site boundary, approximately 92 meters southwest of Locus 46. Locus 47 measures 5.0 meters north to south by 3.0 meters east to west, and includes: 14 jasper flakes (one primary, nine secondary, three tertiary, and one shatter), 19 cryptocrystalline silicate flakes (four primary, eight secondary, and seven tertiary), and two basalt tertiary flakes.

Locus 48 is also located along the southwestern site boundary, approximately 35 meters north of Locus 47. Locus 48 measures 7.0 meters north to south by 6.0 meters east to west, and includes 85 jasper flakes (eight primary, 39 secondary, 19 tertiary, and 19 shatter).

Locus 49 is located along the northwestern site boundary, approximately 172 meters northeast of Locus 48. Locus 49 measures 3.0 meters north to south by 5.0 meters east to west, and includes 15 cryptocrystalline silicate flakes (three primary, six secondary, two tertiary, and four shatter) and one cryptocrystalline silicate multi-directional core.

A total of 469 historical artifacts were observed outside of the loci. The following inventory of artifacts includes 300 fragments of bottle glass in various colors (brown, cobalt, colorless, aqua, green, olive, amethyst), five fragments of colorless glass from a single Mason jar, 10 fragments of brown glass from a single alcohol bottle embossed with “FEDERAL LAW PROHIBITS SALE OR REUSE OF THIS BOTTLE” on body (1933-1964: Munsey 1970:126) and “MTC” on base (Thatcher Manufacturing Company, 1900 to present: Toulouse 1971:496), one amber bottle, 15 porcelain tableware fragments, 20 whiteware plate fragments, eight “pop top” bimetal cans, 18 single-serve (six to 20 ounce) sanitary fruit/vegetable cans (14 rotary opened and four bayonet opened), five multi-serve (over 25 ounces) sanitary fruit/vegetable cans (four rotary opened and one P38 opened with solder pin through crimped side seam), four matchstick filler cans all single ring embossed (2 5/16”D × 4 6/16”H), one hole-in-top can (2 10/16”D × 4 4/16”H) bayonet opened, eight church key opened beverage cans (post 1935: IMACS User’s Guide 2001:471-6), three eight to 12 ounce rectangular meat cans with side key-strip opening, three six to eight ounce oval fish tines (rotary opened), one sanitary can (2 15/16”D × 4 9/16”H) knife punched opened with “Sanitary” stamped on the base, two one-pound external friction coffee cans, one 16 to 32 ounce paint can (key-strip, pull to lift), four aerosol spray cans, two one-gallon buckets, two large pour spout gasoline cans, two oil can lids, one oil pan, one five gallon corrugated recycled drum (holes punched in side), two church key opened quart sized oil cans embossed with “MFD / BY / STANDARD / OIL / COMPANY / OF / CALIFORNIA // WESTERN / OPERATIONS / INC. // S.A.E. // 10W // SAN FRANCISCO” on the top of the can, one piece of iron railroad equipment with attached circuit board components with placard that reads “Type C / MAGNETIC / CONTACTOR / W (over oval in circle) / (7-21-26) / From 30 CS (in rectangle)”, one light fixture (9 1/2”D), one kerosene lamp/heater with tag that reads “Hastings 114”, four fragments of sheet metal, three iron brackets, and more than 40 fragments of milled wood in various sizes.

In total, 349 prehistoric artifacts were observed outside the loci, including: 246 jasper flakes (57 primary, 102 secondary, 46 tertiary, 19 shatter, and 22 of unreported type), 63 cryptocrystalline silicate flakes (20 primary, 29 secondary, 12 tertiary, one shatter, and one of unreported type), 11 chalcedony flakes (one primary, six secondary, two tertiary, and two of unreported type), two basalt flakes (one primary and one shatter), 10 chert flakes of unreported type, one jasper unifacial core, two cryptocrystalline silicate cores, four jasper and cryptocrystalline silicate bifaces, two jasper edge modified flakes, one granitic basalt metate, and seven tested cobbles (five jasper and two cryptocrystalline silicate). The potential for subsurface deposits on the fan remnant is low, as geologic sources indicate the fan remnant dates to the Early-to-Middle Pleistocene (Rogers 1967); however, intact desert pavement may be covered by eolian deposits in a small portion of the site. Nonetheless, considering the site types, a complex lithic and ground stone scatter and historical refuse scatter, it is highly likely that any artifacts present in subsurface contexts would mirror those artifact types already identified.

Two historical features appear to be related to the military use of the Mojave Desert as a training area. Feature 2 is a circular rock feature with the phrase “Pisgah 2077-30” spelled out in stones within the feature. The rock alignment is in the vicinity of the Pisgah Substation and Pisgah railroad siding, and the number “2077” likely refers to the elevation of the area. The rock alignment was possibly used as an aerial observation point for military planes, including those that were taking aerial photographs for mapping. Feature 3 is a metal windsock stand, which is consistent with the military use of the area.

An aviation runway, composed of two rock alignments running parallel to each other in an east west direction, partially bisects this combined site. The runway is presumed to be associated with this site, specifically with Features 2 and 3.

No temporally diagnostic historical artifacts were found near any of the seven features. The remaining five features (a fence post, a concrete pad, and three rock clusters), not associated with military use, could not be dated or associated with any specific historical time period. Given the structure of the three rock clusters (Features 4, 5 and 7), it is noteworthy that they cannot be definitively determined to be historic in age. The site is situated within a large recreational area which is frequently used by OHVs. It is possible that the stone clusters are modern in age and perhaps were expediently placed to provide visible landmarks to facilitate navigation.

Based upon the cultural constituents, archaeologists for the Applicant interpret the prehistoric component of this multiple activity site as a lithic procurement and initial lithic reduction locality where limited resource processing activities occurred. The lithic materials appear to be derived from cobbles of toolstone quality found on site within the desert pavement surfaces, and the artifact types identified (unifacial, bifacial, and multi-directional cores, tested cobbles, edge modified flakes, early stage bifaces, and a preponderance of cortical debitage) reflect early stage biface reduction. Such artifacts indicate percussion (hard-hammer and/or soft-hammer) reduction (Andrefsky Jr. 2008; Odell 2004; Whittaker 1994). Due to the presence of a ground stone artifact (metate), it appears that limited resource procurement and/or processing was also occurring within the site area.

The historical refuse scatter identified on site appears to date from early 1930s to late 1950s, and includes: bottle and jar glass fragments, ceramic tableware fragments, various food and beverage cans, various paint and oil cans, machine and automobile parts, miscellaneous metal items (i.e., wire, banding, mesh), and construction debris (i.e., concrete, brick, lumber, asphalt). Church key opened cans date from 1935 and thereafter (IMACS User's Guide 2001:471-6). Bottles embossed with "FEDERAL LAW PROHIBITS SALE OR REUSE OF THIS BOTTLE" date from 1933-1964 (Munsey 1970:126). Bottles embossed with "Duraglas (in script)" date from 1940 (Toulouse 1971:170). One bottles dates since 1954 (Toulouse 1971:403) and another bottle since 1957 (Toulouse 1971:316). Though manufacture dates can be determined for some of the artifacts present at combined site CA-SBR-13349/H, the time between the initial use/consumption of the artifacts and their ultimate disposal cannot be known. Therefore, the specific date of their disposal cannot be reliably determined.

Due to the close proximity of the National Trails Highway (crosses through the site), to combined site CA-SBR-13349/H and the fact that the historical refuse scatter is widely spread throughout the site area, the archaeologists for the Applicant believe that the historical refuse is the result of numerous random episodes of refuse disposal associated with travel on the Old National Trails Highway during the early 1930s and to the construction of the Pisgah substation and transmission lines from 1938 to 1940. More recent refuse dating from the mid-to-late 1950s may be attributed to steady OHV use of the area.

This site lacks prehistoric artifacts with unique or temporally diagnostic characteristics, and the material remains cannot be associated with a specific period of prehistory or ethnohistory. Documentation of the artifact distribution has been conducted during the recordation process. Combined site CA-SBR-13349/H is situated on a nearly level erosional fan remnant composed of moderate- to well-developed desert pavement consisting of poorly sorted sub-angular to sub-rounded pebbles and cobbles. This geomorphic landform indicates an Early-to-Middle Pleistocene (Rogers 1967) period of formation and because the formation of this landform predates human presence in the area, there is very low likelihood for subsurface archaeological deposits.

CA-SBR-13350

In October 2009, archaeological sites CA-SBR-13033, -13034, -13036, -13120, and -13121 were reexamined as part of the Calico Solar Project. Additional artifacts were discovered between these sites and CA-SBR-13035, P-36-014697, P-36-014698, P-36-014699, P-36-014700, P-36-014701, P-36-014702, P- 36-014703, P-36-014704, and P-36-014708. As a result of the survey, these sites were combined to form CA-SBR-13350. CA-SBR-13033 was originally described as a prehistoric site, measuring 313 meters north to south by 416 meters east to west, containing 763 cryptocrystalline silicate (chert, chalcedony, and jasper) artifacts including primary, secondary, and tertiary flakes, cores, and bifaces. CA-SBR-13034 was originally described as a discrete prehistoric lithic scatter, measuring 35 meters north to south by 14 meters east to west, containing five chalcedony flakes and one jasper flake. CA-SBR-13035 was originally described as a discrete prehistoric lithic scatter, measuring 59 meters northwest to southeast by 9.0 meters northeast to southwest, containing 44 cryptocrystalline silicate flakes. CA-SBR-13036 was originally described as a discrete prehistoric lithic scatter, measuring 158 meters north to south by 60 meters east to west, containing 50 primary, secondary, and tertiary flakes, and two bifaces. CA-SBR- 13120 was originally described as a prehistoric site, measuring 25 meters north to south by 121 meters east to west, containing 20 cryptocrystalline silicate chert and chalcedony artifacts including primary, secondary, and tertiary flakes, cores, a biface, and an edge modified flake. CA-SBR-13121 was originally described as a prehistoric site, measuring 125 meters north to south by 397 meters east to west, containing 135 cryptocrystalline silicate (chert, chalcedony, and jasper) artifacts including primary, secondary, and tertiary flakes, cores, bifaces, and assayed cobbles. P-36-014697 was originally described as an isolate consisting of four flakes (chalcedony and jasper). P-36-014698 was originally described as an isolate consisting of one chalcedony tertiary flake. P-36-014699 was originally described as an isolate consisting of one chalcedony secondary flake. P-36-014700 was originally described as an isolate consisting of one chert tertiary flake. P-36-014701 was originally described as an isolate consisting of four flakes (chalcedony and chert). P-36-014702 was originally described as an isolate consisting of three chalcedony flakes. P-36-014703 was originally described as an isolate consisting of three flakes (chalcedony and chert). P-36-014704 was originally described as an isolate consisting of one chalcedony secondary flake. P-36-014697 was originally described as an isolate consisting of three flakes (chalcedony and jasper). While CA-SBR-13037, a trending trail or footpath of possible prehistoric origin, is located 4 meters north of the northwestern boundary of this site, it is not included with the abovementioned sites. However, it should be noted that this trail or footpath (CA-SBR-13037) is likely associated with combined site CA-SBR-13350.

Combined Site CA-SBR-13350 is a complex lithic scatter that covers a total surface area of 168,706 square meters. The site is located within the southwestern portion of the Phase 2 area of the Calico Solar Project site. The site is situated on an alluvial flat, or flood plain, formed along two major north and northeast trending tributaries of the axial channel draining the valley. The alluvial flat landform dominates the western part of the southern portion of the Calico Solar Project area, and can be distinguished from other landforms in the southern area by a nearly flat, low lying surface that is cut by numerous braided and anastomatizing channels/gullies. These channels are dominantly oriented in the same direction as the major axial channel (see above) that crosses the project area. Between these small channels/gullies tend to be bars of poorly developed desert pavement. This landform is largely found adjacent to the axial channel. Due to the construction of I-40, the hydrology of this area has been altered and caused the incising of the primary channels transecting the site. Recent overbank deposits cover portions of the site surface. Poorly sorted and poorly to moderate-developed desert pavement is common throughout the site area as discontinuous concentrations separated by small north and northeast trending gullies and shallow drainage features. Site sediments are fine to medium grained silty sand with sub-angular to sub-rounded pebbles and cobbles of cryptocrystalline silicates (e.g., jasper, chert, and chalcedony), basalt, and other volcanic materials. The Pisgah lava flow forms the western boundary of the site and sand sheet development is evident along the base of the flow. Limited eolian deposits consisting of small coppice dunes and in-filled channels cover less than five percent of the site. North of the site is the relict alluvial flat formed along the axial channel for the valley which consists of a series of west trending braided and anastomatizing channels separated by bars of moderate- to well developed desert pavement. The potential for buried artifacts at this site is high; however, due to reworking of the local sediments by the wash, buried artifacts are likely in secondary disturbed context and the chances of finding intact surfaces and features is low.

Vegetation in the site area and vicinity is dominated by the Creosote Bush Community which is characteristic of the Mojave Desert where rainfall is less than 19 centimeters annually. Within the site area, observed vegetation includes creosote bush (*Larrea tridentata*), desert saltbush (*Artiplex polycarpa*), and silver cholla (*Opuntia* sp.).

This complex lithic scatter measures 1,220 meters northwest to southeast by 520 meters northeast to southwest, and contains a total of 1,416 prehistoric artifacts including: 1,113 chalcedony flakes (152 primary, 558 secondary, 329 tertiary, 21 biface thinning, and 53 shatter), 172 chert flakes (22 primary, 65 secondary, 66 tertiary, three biface thinning, and 16 shatter), 66 jasper flakes (three primary, 24 secondary, 22 tertiary, and 17 biface thinning), five rhyolite flakes (one primary and four secondary), one metavolcanic primary flake, 12 chert bifaces, 19 chalcedony bifaces, two jasper bifaces, six chert cores, three chalcedony cores, one jasper core, one chert edge modified flake, one chalcedony edge modified flake, four utilized flakes (three chalcedony and one jasper), one jasper flaked cobble tool, one jasper preform, two chalcedony preforms, one chalcedony scraper, one chalcedony hammerstone, and four chalcedony tested cobbles. Artifact density at CA-SBR-13073 is low, with a calculated distribution of one artifact per 119.14 square meters. The overall condition of the site is fair to poor due to heavy grading along the southern boundary (CALTRANS R.O.W [Interstate 40] fence).

Of the 1,416 artifacts identified, 124 artifacts occur within seven discrete loci (i.e., Loci 1-7) with higher concentrations of artifacts; the remaining cultural materials identified occur outside of these designated loci. Loci 1, 2, 3, and 4 are situated within the floodplain, while Loci 5, 6, and 7 are located along the western boundary of the site next to the Pisgah lava flow.

Locus 1 is located along the southwestern site boundary, measures 1.5 meters north to south by 1.5 meters east to west, and includes 13 chalcedony flakes (five primary, three tertiary, and five shatter), and one chert unifacial core.

Locus 2 is also located along the southwestern site boundary, approximately 96 meters west of Locus 1. Locus 2 measures 10.9 meters north to south by 17 meters east to west, and includes 16 chalcedony flakes (one primary, five secondary, six tertiary, and four shatter) and one chalcedony edge modified flake.

Locus 3 is also located along the southwestern site boundary, approximately 46 meters east of Locus 2. Locus 3 measures 6.8 meters north to south by 7.1 meters east to west, and includes 10 chalcedony flakes (two primary, four secondary, one tertiary, and three shatter), and one chalcedony biface.

Locus 4 is located along the central-southern site boundary, approximately 580 meters west of Locus 3. Locus 4 measures 2.0 meters north to south by 1.5 meters east to west, and includes 15 chert flakes (five primary, four secondary, and six shatter).

Locus 5 is located along the western site boundary, approximately 300 meters northwest of Locus 4. Locus 5 measures 7.0 meters north to south by 4.0 meters east to west, and includes: 22 jasper flakes (two secondary, seven tertiary, and 13 biface thinning), 21 chalcedony flakes (one primary, four secondary, seven tertiary, four biface thinning, and five shatter), three chert flakes (one secondary and two tertiary), one rhyolite secondary flake, and one jasper biface.

Locus 6 is located within the southwestern site boundary, approximately 152 meters southeast of Locus 5. Locus 6 measures 8.0 meters northeast to southwest by 2.0 meters northwest to southeast, and includes 14 chalcedony flakes (one primary, seven secondary, five tertiary, and one shatter).

Locus 7 is located along the northwestern site boundary, approximately 368 meters northwest of Locus 6. Locus 7 measures 12 meters north to south by 4.0 meters east to west, and includes two chalcedony preforms and three chalcedony biface fragments.

In total, 1,292 prehistoric artifacts were observed outside the loci, including 1,039 chalcedony flakes (142 primary, 538 secondary, 307 tertiary, 17 biface thinning, and 35 shatter), 154 chert flakes (17 primary, 60 secondary, 64 tertiary, three biface thinning, and 10 shatter), 44 jasper flakes (three primary, 22 secondary, 15 tertiary, and four biface thinning), four rhyolite flakes (one primary and three secondary), one metavolcanic primary flake, 12 chert bifaces, 15 chalcedony bifaces, one jasper biface, five chert cores, three chalcedony cores, one jasper core, one chert edge modified flake, four utilized flakes (three chalcedony and one jasper), one jasper flaked cobble tool, one jasper preform, one chalcedony scraper, one chalcedony hammerstone, and four chalcedony tested cobbles.

The potential for buried artifacts at some portions of this site is high. Loci 1, 2, 3, and 4 have the highest potential for buried artifacts, as they are within the floodplain; however, due to reworking of the local sediments by the wash, buried artifacts are likely in disturbed secondary context and the chances of finding intact surfaces and features is low. The site is situated primarily on an alluvial flat or floodplain and is highly disturbed.

Based upon the cultural constituents and the physical context, archaeologists for the Applicant interpret this site as a lithic procurement and lithic reduction locality. The lithic materials appear to be derived from cobbles of toolstone quality found on site within the desert pavement surfaces, and the artifact types identified (unidirectional, bifacial, and multi-directional cores, tested cobbles, edge modified flakes, utilized flakes, bifaces, a hammerstone, and primary, secondary, tertiary, and biface thinning flakes) reflect early-to-late stage biface reduction. Such artifacts indicate percussion (hard-hammer and/or softhammer) and pressure reduction (Andrefsky Jr. 2008; Odell 2004; Whittaker 1994).

Because this site lacks prehistoric artifacts with unique or temporally diagnostic characteristics, the material remains cannot be associated with a specific period of prehistory or ethnohistory. Additionally, this site cannot reliably be associated with any distinctive or significant event, person, design, or construction, and the artifact distribution has been documented during the recordation process. While the potential for buried artifacts at some portions of this site is high, due to reworking of the local sediments by the wash, buried artifacts are likely in secondary disturbed context and the chances of finding intact surfaces and features is low. In addition, combined site CA-SBR-13350 is situated primarily on an alluvial flat or flood plain and is highly disturbed. Therefore, data potential is considered exhausted through recordation of combined site CA-SBR-13350.

CA-SBR-13441

In October 2009, archaeological sites CA-SBR-13057 and CA-SBR-13058 were resurveyed as part of the Calico Solar Project. Additional artifacts were discovered between the two site boundaries, and as a result of the survey, these sites were combined to form combined site CA-SBR-13441. CA-SBR-13057 was originally described as a discrete prehistoric lithic scatter, measuring 64 meters east to west by 37 meters north to south, containing seven flakes and one core. CA-SBR-13058 was originally described as a discrete prehistoric lithic scatter, measuring 28 meters east to west by 80 meters north to south, containing 11 flakes and two cores (one of which is in two pieces).

Combined Site CA-SBR-13441 is an amorphous-shaped low density lithic reduction scatter and covers a total surface area of 2,842 square meters.

The site is located within the southern central portion of the Phase 2 area of the Calico Solar Project site. The site is situated on a nearly level inset alluvial fan facing northwest. The inset fan comprises the portion of the alluvial deposition in the southern Calico Solar Project area, which is confined between two or more fan remnants (or older higher elevation landforms). The fan types may appear similar to the alluvial fan piedmont or the alluvial flat (but without dominant erosional features oriented east to west). The alluvial fan piedmont is the large, gently sloping depositional feature that dominates the northern portion of the Calico Solar Project area; commonly referred to as a “bajada.” As a whole, this appears to be a much younger landform than those in the southern portion of the Calico Solar Project area. The alluvial flat is similar to the relict alluvial flat landform (see below), but younger, with less developed pavement and less dissected, and will largely be found adjacent to the axial channel (see below). The relict alluvial flat landform dominates the western part of the southern portion of the Calico Solar Project area, and can be distinguished from other relict landforms in the southern area by a nearly flat, low lying surface that is cut by numerous braided and anastomatizing channels/gullies. Between these small channels/gullies tend to be bars of intact desert pavement (indicating a relative antiquity for the landform and thus use of the term “relict”).

The main channel of a northwestward trending wash is located several meters southwest of the site. Poorly developed and poorly sorted desert pavement covers portions of the site in an irregular patchy pattern, suggesting portions of the alluvial fan are temporarily stable. Most artifacts tend to be located within areas where pavement is present. Site sediments are silty fine to medium grained sand with small to large sub-angular to sub-rounded pebbles and cobbles. Approximately 1 mile north of the site, the wash merges with the axial channel for the valley. East and west of the site bounding the inset alluvial fan are fan remnants; low northwest trending hills covered by a well-developed desert pavement. Vegetation in the site area and vicinity is dominated by the Creosote Bush Community which is characteristic of the Mojave Desert where rainfall is less than 19 centimeters annually. Within the site area, observed vegetation includes creosote bush (*Larrea tridentata*), burrobush (*Ambrosia dumosa*), and desert saltbush (*Artiplex polycarpa*), as well as bunch grasses that were unidentifiable during the archaeological survey.

This lithic reduction scatter measures 267 meters northwest to southeast by 62 meters northeast to southwest, and contains a total of 64 prehistoric artifacts. Artifact density at combined site CA-SBR- 13441 is low, with a calculated distribution of one artifact per 44.40 square meters. The overall condition of this site is fair. However due to its location, the area is prone to flash flooding, so sediments are generally unstable.

The major physical surface characteristic of this site is a lithic reduction scatter containing approximately 64 cryptocrystalline silicate (jasper, chalcedony, and chert), rhyolite, and agate artifacts, which include: 46 red jasper flakes (nine primary, 20 secondary, 11 tertiary, and six shatter), two rhyolite secondary flakes, one mustard cryptocrystalline silicate secondary flake, three yellow chalcedony/chert flakes (one secondary and two tertiary), four brown chalcedony/chert flakes (one primary, two secondary, and one tertiary), one agate primary flake, and seven multi-directional jasper cores.

The potential for buried artifacts at this site is high; however, reworking of the local sediments by the wash suggests that buried artifacts are in secondary disturbed context. As well, the likelihood of finding intact surfaces and features is low.

Based upon the cultural constituents and the physical context, archaeologists for the Applicant interpret this site as a low density lithic reduction scatter. The lithic materials appear to be derived from cobbles of toolstone quality found on site within the desert pavement surfaces, and the artifact types identified (multi-directional cores and debitage consisting of primary, secondary, and tertiary flakes) reflect lithic reduction activities. Such artifacts indicate percussion (hard-hammer and/or soft-hammer) reduction

(Andrefsky Jr. 2008; Odell 2004; Whittaker 1994). Because the majority of lithic materials reduced in this lithic scatter are of the same primary stone material (jasper) that is a constituent of the surrounding area and exhibit expedient lithic reduction methods of percussion reduction processes, the site appears to represent one single reduction locality or episode.

This site lacks artifacts with unique or temporally diagnostic characteristics and the material remains cannot be associated with a specific period of prehistory or ethnohistory. Analysis of the artifact distribution has been accounted for during the recordation process. As mentioned above, combined site CA-SBR-13441 is situated on a nearly level inset alluvial fan. The potential for buried artifacts at this site is high; however, reworking of the local sediments by the wash suggests that buried artifacts are in secondary disturbed context. As well, the likelihood of finding intact surfaces and features is low. Considering the artifact assemblage identified on site, consisting of cores and debitage, which are indicative of lithic reduction activities, it is highly likely that any artifacts present in subsurface contexts would mirror those artifact types already identified. Therefore, the data potential is considered exhausted through recordation of combined site CA-SBR-13441.

CA-SBR-13442

In October 2009 archaeological sites CA-SBR-13001 and CA-SBR-13043 were re-examined as part of the Calico Solar Project. Additional artifacts were discovered between the two site boundaries, and as a result of the survey, these sites were combined to form CA-SBR-13442. CA-SBR-13001 was originally described as a discrete sparse density complex lithic scatter, measuring 33 meters northeast to southwest by 29 meters northwest to southeast, containing six flakes, one hammerstone, and a flaked cobble tool. CA-SBR-13043 was originally described as a discrete prehistoric lithic scatter, measuring 207 meters east to west by 44 meters north to south, containing 84 flakes, one edge modified flake and six loci with higher concentrations of artifacts.

Combined site CA-SBR-13442 is an amorphous-shaped sparse density complex lithic scatter that covers a total surface area of 9,971.3 square meters. The site is located within the central portion of the Phase 2 area of the Calico Solar Project site. The site is situated on the toe slope of a nearly level (1º slope) erosional fan remnant facing west northwest. The erosional fan remnant is composed of hills and ridges that extend above, and are surrounded by, the other landforms in the southern portion of the Calico Solar Project area. They generally are composed of a summit with moderately- to well-developed desert pavement (due to both parent material and age) and erosional side slopes that generally lack pavement. Within the southern Calico Solar Project area, these fan remnants are generally composed of a very old (Early-to-Middle Pleistocene) fanglomerate of cobbles and coarse gravels. Moderately developed desert pavement covers approximately 40% of the site and consists of poorly sorted sub-angular to sub-rounded pebbles and cobbles. The continuity of the desert pavement is broken by shallow west trending gullies dissecting the slope. Loci and most artifacts tend to be located in areas where desert pavement is present. Limited eolian deposits consist of small coppice dunes and minor accumulations of sand around the base of vegetation and in-filling gullies and cover less than two percent of the site. Approximately 500 meters north of the site is the axial channel for the valley and 100 meters west is a north trending wash. The fan remnant on which the site is located continues for 1,000 meters east and 450 meters north and is dissected by numerous shallow gullies; a second fan remnant is present 500 meters west. Vegetation in the site area and vicinity is dominated by the Creosote Bush Community which is characteristic of the Mojave Desert where rainfall is less than 19 centimeters annually. Within the site area, observed vegetation includes creosote bush (*Larrea tridentata*) and desert saltbush (*Artiplex polycarpa*), as well as bunch grasses that were unidentifiable during the archaeological survey.

This sparse density lithic reduction scatter measures 40 meters north to south by 283 meters east to west, and contains a total of 108 prehistoric artifacts. Artifact density at combined site CA-SBR-13442 is low, with a calculated distribution of one artifact per 92.32 square meters. However, six discrete loci with higher concentrations of cultural materials interpreted to be single reduction loci do occur within the site area. The overall condition of this site is good with no visible alterations.

The major physical surface characteristic of this site is a lithic reduction scatter containing approximately 108 cryptocrystalline silicate jasper artifacts and basalt artifacts, which include: 97 pieces of lithic debitage (70 primary, 24 secondary, two tertiary, and one shatter), seven jasper cores, two jasper tested cobbles, one basalt flaked cobble tool, and one basalt hammerstone. Of the 108 artifacts identified, 90 artifacts occur within six discrete loci (i.e., Loci 1-6) with higher concentrations of artifacts situated on moderately developed desert pavement surfaces; the remaining cultural materials identified occur outside of these designated loci.

Locus 1 is located along the central-northwestern site boundary, measures 1.3 meters north to south by 0.7 meters east to west, and contains seven red cryptocrystalline silicate jasper flakes (four primary, two secondary, and one tertiary), and two red cryptocrystalline silicate jasper bifacial cores.

Locus 2 is located along the central-southern site boundary, approximately 45 meters southeast of Locus 1. Locus 2 measures 1.5 meters north to south by 2.0 meters east to west, and contains six red cryptocrystalline silicate jasper flakes (two primary and four secondary) and one red cryptocrystalline silicate jasper bifacial core.

Locus 3 is located along the central-northern site boundary, approximately 40 meters northeast of Locus 2. Locus 3 measures 6.9 meters northeast to southwest by 3.1 meters southeast to northwest, and contains 12 red cryptocrystalline silicate jasper flakes (11 primary and one secondary) and one red cryptocrystalline silicate jasper bifacial core.

Locus 4 is located along the central-southwestern site boundary, approximately 47 meters southeast of Locus 3. Locus 4 measures 2.4 meters north to south by 3.6 meters east to west, and contains 13 red cryptocrystalline silicate jasper flakes (10 primary and three secondary).

Locus 5 is located along the southwestern site boundary, approximately 60 meters southeast of Locus 4. Locus 5 measures 1.6 meters north to south by 2.8 meters east to west, and contains 33 red cryptocrystalline silicate jasper flakes (28 primary and five secondary), one red cryptocrystalline silicate jasper unidirectional core, and one red cryptocrystalline silicate jasper bifacial core.

Locus 6 is also located along the southwestern site boundary, approximately 22 meters northeast of Locus 5. Locus 6 measures 2.6 meters north to south by 4.2 meters east to west, and contains 13 red cryptocrystalline silicate jasper flakes (11 primary and two secondary).

Those artifacts observed outside of the loci consist of 13 red cryptocrystalline silicate jasper flakes (four primary, seven secondary, one tertiary, and one shatter), two jasper tested cobbles, one basalt hammerstone, one basalt flaked cobble tool, and one jasper bifacial core. The further character of artifacts associated with this site is reported on DPR 523 series forms under a confidential filing.

The potential for buried artifacts is low as geologic sources indicate the fan remnant dates to the Early-to- Middle Pleistocene (Rogers 1967); however, artifacts associated with the surface pavement may be covered by eolian sands in limited areas (approximately two percent) of the site. However, considering the artifact assemblage identified on site which consists of cores, tested cobbles, a flaked cobble tool, a hammerstone, and a large percentage of cortical debitage (70 of 97 debitage items, or 72.2%), all of which are indicative of initial lithic reduction activities, it is highly likely that any artifacts present in subsurface contexts would mirror those artifact types already identified.

Based upon the cultural constituents and the physical context, archaeologists for the Applicant interpret this site as a sparse density lithic procurement and initial lithic reduction locality. The lithic materials appear to be derived from cobbles of toolstone quality found on site within the desert pavement surfaces, and the artifact types identified (unidirectional and bifacial cores, a hammerstone, tested cobbles, a flaked cobble tool, and a preponderance of cortical debitage) reflect early stage biface reduction. Such artifacts indicate percussion (hard-hammer and/or soft-hammer) reduction (Andrefsky Jr. 2008; Odell 2004; Whittaker 1994). Additionally, all six loci identified are comprised of only one type of lithic material (jasper), which is interpreted as single reduction loci. Thus, the site appears to represent a minimum of six episodes or localities of early stage biface reduction.

This site lacks artifacts with unique or temporally diagnostic characteristics, and the material remains cannot be associated with a specific period of prehistory or ethnohistory. Analysis of the artifact distribution has been accounted for during the recordation process. Combined site CA-SBR-13442 is situated on the toe slope of a nearly level erosional fan remnant composed of moderately developed desert pavement consisting of poorly sorted sub-angular to sub-rounded pebbles and cobbles. This geomorphic landform indicates a Early-to Middle-Pleistocene (Rogers 1967) period of formation and because the formation of this landform predates human presence in the area, there is very low likelihood for subsurface archaeological deposits; therefore, data potential is considered exhausted through recordation of combined site CA-SBR-13442.

CA-SBR-13443-H

In October 2009 archaeological site CA-SBR-13023/H was resurveyed as part of the Calico Solar Project. As a result of the survey, additional artifacts were discovered between this site boundary and the site boundaries of CA-SBR-13077 and P-36-014795 (isolated artifact); therefore, these sites and the isolated artifact were combined to form combined site CA-SBR-13443/H. CA-SBR-13023/H was originally described as a multi-component site, measuring 43 meters northwest to southeast by 48 meters northeast to southwest, containing a total of 23 historical artifacts (bottle/jar glass fragments, cans, iron fasteners, and two sheets of metal), four prehistoric artifacts (one mano, one metate, and two flakes), and two loci with higher concentrations of artifacts. CA-SBR-13077 was originally described as a discrete prehistoric lithic scatter, measuring 8 meters north to south by 10 meters east to west, containing 11 cryptocrystalline silicate flakes. P-36-014795 was originally described as an isolated find consisting of three red cryptocrystalline silicate jasper tertiary flakes.

Combined Site CA-SBR-13443/H is an amorphous-shaped very sparse density multi-component site that covers a total surface area of 14,213.6 square meters; the site is characterized by a scatter of historical refuse and prehistoric lithic materials. The site is located within the central portion of the Phase 2 area of the Calico Solar Project site. The site is situated at the intersection of multiple alluvial landforms, including the toe of the younger alluvial fan piedmont issuing from the Cady Mountains to the north, the toe slope of an older erosional fan remnant to the south, and a west trending active axial channel that transects the two landforms. An alluvial fan piedmont is the large, gently sloping depositional feature that dominates the northern portion of the Calico Solar Project area; commonly referred to as a “bajada.” As a whole, this appears to be a much younger landform than those in the southern portion of the Calico Solar Project area. The erosional fan remnant is the hills and ridges that extend above, and are surrounded by, the other landforms in the southern portion of the Calico Solar Project area. They generally are composed of a summit with moderately- to well-developed desert pavement (due to both parent material and age) and erosional side slopes that generally lack pavement. Within the southern Calico Solar Project area, these fan remnants are generally composed of a very old (Early-to-Middle Pleistocene) fanglomerate of cobbles and coarse gravels. The axial cannel is the large east-west trending drainage that separates the toe of the alluvial fan piedmont, from the relict (older) landscape that dominates the southern portion of the Calico Solar Project area.

The slope is less than one percent and faces generally to the west. On the surface, a limited portion of the site is covered with discontinuous concentrations of poorly sorted sub-angular to sub-rounded pebbles and cobbles. Medium to course sub-angular grains of sand and small pebbles moderately cover the surface between concentrations suggesting wind erosion is actively affecting the surface by removing the finer fraction of the sediment. Site sediments consist of unconsolidated fine to medium grained alluvial sand with sub-angular to sub-rounded pebbles, cobbles, and gravels, which have likely been reworked and deposited by the axial channel. Vegetation in the site area and vicinity is dominated by the Creosote Bush Community which is characteristic of the Mojave Desert where rainfall is less than 19 centimeters annually. Within the site area, observed vegetation includes creosote bush (*Larrea tridentata*) and desert saltbush

(*Artiplex polycarpa*), as well as bunch grasses that were unidentifiable during the archaeological survey.

This multiple activity area measures 130 meters north to south by 305 meters east to west, and contains both a prehistoric complex lithic and ground stone scatter and a historical refuse scatter. Two loci with a higher concentration of prehistoric artifacts were identified, and artifact density is low within the site area (one artifact per 149.6 square meters). The overall condition of the site is good, with no visible alterations.

As noted above, the prehistoric component consists of a complex lithic and ground stone scatter that is composed primarily of cryptocrystalline silicate jasper artifacts and contains two loci. Artifacts within the prehistoric component include; 43 cryptocrystalline silicate jasper flakes (six primary, 15 secondary, 20 tertiary, and two shatter), four chalcedony flakes (one primary and three tertiary), one white chert tertiary flake, five chert flakes (four secondary and one tertiary), one complete granitic bifacial mano, one nearly complete metavolcanic basin metate, one jasper biface, and one chalcedony unidirectional scraper.

Of the 43 artifacts identified within the prehistoric component, 14 artifacts occur within two discrete loci (i.e., Loci 1 & 2) with higher concentrations of artifacts; the remaining cultural materials identified occur outside of these designated loci.

Locus 1 is located within the eastern portion of the site, measures 17.0 meters north to south by 21.0 meters east to west, and contains six red jasper flakes (two secondary and four tertiary), one complete granitic bifacial mano, one nearly complete metavolcanic basin metate, and one chalcedony unidirectional scraper.

Locus 2 is located within the western portion of the site, approximately 125 meters due west of Locus 1. Locus 2 measures 2.5 meters northwest to southeast by 1.6 meters northeast to southwest, and contains five chert flakes (four secondary and one tertiary).

The historical component is scattered widely throughout the site area and consists of a historical refuse scatter composed of approximately 38 items, including bottle/jar glass fragments, various cans, machine parts, and miscellaneous metal items. Artifacts within the historical component include: various sanitary cans including a juice can and a church key opened beer can (2 3/4 ”D × 4 7/8”H) (post 1935: IMACS User’s Guide 2001:471-6), Hole-and-Cap cans of various sizes (4”D × 5”H, 3 1/2”D × 4 5/8”H, 4”D × 4 3/4”H [2], 3”D × 3 5/16”H, 4 1/4”D × 6 3/8”H) both knife and cross cut opened, an ice-pick opened condensed milk can (1908-1914: IMACS User’s Guide 2001:471-9), two lard buckets (one reads “White Blossom / Extra Refined Lard / Expressly for Family Use / Kansas City” on the body and measures 6 7/8”H, the other measures 6”D × 7”H), miscellaneous can fragments, a large bucket with a wire handle (10 1/2”H), two metal machine parts (11 1/4”L × 2”W × 1/2”H each), an internal compression ring, a barrel lid fragment (3 1/4”D), a piece of 1/16” wire, a horseshoe, approximately 40 brown glass bottle fragments from five bottles; one with “K” on the base (Kinghorn Bottle Co., 1907-1920: Toulouse 1971:299) and one with “…O” on the base, and a minimum of seven aqua glass fragments from a single bottle embossed with “SCOTT / EMULS[ION] / CO[D] / LIVER” on the body (introduced 1876: Fike 1987:196).

The potential for buried artifacts at this site is high due to the location of the site at the intersection of multiple alluvial landforms; however, reworking of the local sediments by the axial channel suggests that buried artifacts are in secondary disturbed context and the likelihood of finding intact surfaces and features is low.

Based upon the cultural constituents, archaeologists for the Applicant interpret the prehistoric component of this multiple activity site as a possible temporary camp where limited resource processing activities occurred. The prehistoric cultural constituents consist of 43 flakes (seven primary, nine secondary, 25 tertiary, and two shatter), one complete granitic bifacial mano, one nearly complete metavolcanic basin metate, one jasper biface, and one chalcedony unidirectional scraper. Nearly half of this debitage assemblage consists of tertiary flakes (47.2%), suggestive of early-to-late stage bifacial reduction activities. Because the majority of lithic materials (77.2%) found within the site are of the same primary stone material (jasper) that is a constituent of the surrounding area, the bulk of the flaked stone assemblage appears to represent one single episode or locality of lithic reduction. However, it should not be discounted that formed artifacts within this locality may have been collected and/or used elsewhere. Due to the presence of ground stone artifacts (mano and metate), it appears that limited resource procurement and/or processing was also occurring within the site area.

The historical refuse scatter identified on site appears to date from the early-to-middle 1900s, and includes: a church key opened beer can, various sanitary food cans, Hole-and-Cap cans of various sizes, two lard buckets, miscellaneous can fragments, a large bucket, two metal machine parts, an internal compression ring, a barrel lid fragment, a piece of 1/16” wire, a horseshoe, approximately 40 brown glass bottle fragments from five bottles, and a minimum of seven aqua glass fragments from a single bottle. Church key opened cans date from 1935 and thereafter (IMACS User’s Guide 2001:471-6). The condensed milk can dates from 1908-1914 (IMACS User’s Guide 2001:471-9). One of the brown glass bottles date from 1907-1920 (Kinghorn Bottle Co., Toulouse 1971:299). Though manufacture dates can be determined for some of the artifacts present at combined site CA-SBR-13443/H, the time between the initial use/consumption of the artifacts and their ultimate disposal cannot be known. Therefore, the specific date of their disposal cannot be reliably determined.

Due to the close proximity of the BNSF Railroad to combined site CA-SBR-13443/H and the fact that the historical refuse scatter is widely spread throughout the site area, the archaeologists for the Applicant believe that the historical refuse is the result of numerous random episodes of refuse disposal associated with use and/or maintenance of the BNSF Railroad during the early-to-middle 1900s. Conceivably, many of these items (particularly the cans) may have been re-deposited from their primary disposal location and dispersed throughout the site area by water or high winds. Therefore, it is possible that many items may have been associated with temporary encampments and/or settlements that would have been located near or adjacent to the BNSF Railroad (formerly the Atlantic and Pacific Railroad/Atchison, Topeka, and Santa Fe Railroad).

LSA disagrees with the following statement: “The surface manifestation of combined site CA-SBR-13443/H lacks artifacts with unique or temporally diagnostic characteristics that can be associated with specific periods of prehistory or history.”

While the potential for buried artifacts at this site is high, reworking of the local sediments by the axial channel suggests that buried artifacts are in secondary disturbed context and the likelihood of finding intact surfaces and features is low. Regardless, if temporally diagnostic artifacts occur in buried context, combined site CA-SBR-13443/H does have the potential to yield important information about the past, specifically information on prehistoric settlement patterns, subsistence strategies, and trade routes.

CA-SBR-13444

In October 2009, archaeological site CA-SBR-13018 was resurveyed as part of the Calico Solar Project. Additional artifacts were discovered between this site and CA-SBR-13019; as a result of the survey, these sites were combined to form CA-SBR-13444. CA-SBR-13018 was originally described as a prehistoric site, measuring 39 meters north to south by 86 meters east to west, containing 78 cryptocrystalline silicates (jasper and chalcedony), rhyolite, and basalt lithics and two loci with a higher concentration of artifacts. CA-SBR-13019 was originally described as a prehistoric site, measuring 27 meters northwest to southeast by 16 meters northeast to southwest, containing eight flakes and one bi-directional core.

Combined site CA-SBR-13444 is an amorphous-shaped moderate density lithic reduction scatter located within the central portion of the Phase 2 area of the Calico Solar Project site and covers a total surface area of 3,330 square meters. The site is situated on the toe slope of a nearly level (1 degree slope) erosional fan remnant facing northwest. The erosional fan remnant is the hills and ridges that extend above, and are surrounded by, the other landforms in the southern portion of the Calico Solar Project site. They generally are composed of a summit with moderate- to well-developed desert pavement (due to both parent material and age) and erosional side slopes that generally lack pavement. Within the southern Calico Solar Project area, these fan remnants are generally composed of a very old (Early-to- Middle Pleistocene) fanglomerate of cobbles and coarse gravels.

Moderate- to well-developed desert pavement covers approximately 70% of the site and consists of moderately sorted sub-angular to sub-rounded coarse sand grains, and pebbles and cobbles of cryptocrystalline silicates (e.g., jasper, chert, and chalcedony), basalt, and other volcanic materials. The continuity of the desert pavement is broken by shallow northwest trending gullies dissecting the fan. Most loci and artifacts tend to be located in areas where desert pavement is present. Limited eolian deposits, consisting of small coppice dunes and minor accumulations of sand around the base of vegetation and partially in-filled gullies, cover less than five percent of the site. Along the northern site boundary, the landform discontinuously transitions into an alluvial flat. South of the site the fan remnant extends as a series of low northwest aligned ridges, covered by moderate- to well-developed desert pavement, and separated by similarly oriented washes and gullies. The axial channel for the valley, a four- to five-meter-wide west trending wash, is located 220 meters north of the site, and a prominent northwest trending wash draining the remnant fan is located 500 meters east. Vegetation in the site area and vicinity is dominated by the Creosote Bush Community which is characteristic of the Mojave Desert where rainfall is less than 19 centimeters annually. Within the site area, observed vegetation includes creosote bush (*Larrea tridentata*) and desert saltbush (*Artiplex polycarpa*).

This lithic reduction scatter measures 175 meters northwest to southeast by 119 meters northeast to southwest, and contains a total of 147 prehistoric artifacts. Artifact density at combined site CA-SBR- 13044 is moderate, with a calculated distribution of one artifact per 22.65 square meters. However, four discrete loci with higher concentrations of cultural materials, interpreted to be single reduction loci, do occur within the site area. The overall condition of this site is good with no visible alterations.

The major physical surface characteristic of this site is a moderate lithic reduction scatter containing approximately 147 jasper, chalcedony, rhyolite, and basalt artifacts, which include: 129 pieces of lithic debitage (23 primary, 28 secondary, 31 tertiary, two pieces of shatter, and 45 unreported type), nine jasper cores (six bifacial, two multi-directional, and one of unreported type), two basalt cores (one unidirectional and one multi-directional), one chalcedony multi-directional core, one rhyolite unidirectional core, two edge modified flakes (jasper and basalt), and three jasper tested cobbles. Of the 147 artifacts identified, 55 artifacts occur within four discrete loci (i.e., Loci 1-4) with higher concentrations of artifacts situated on moderately developed desert pavement surfaces; the remaining cultural materials identified occur outside of these designated loci.

Locus 1 is located within the western portion of the site, measures 4.0 meters north to south by 1.0 meters east to west, and includes 15 jasper flakes (three primary, five secondary, and seven tertiary), and one jasper bifacial core.

Locus 2 is located along the northwestern site boundary, approximately 12 meters northeast of Locus 1. Locus 2 measures 0.4 meters north to south by 2.3 meters east to west, and includes six jasper flakes (one primary, two secondary, and three tertiary) and one chalcedony multi-directional core.

Locus 3 is located along the central-northern site boundary, approximately 74 meters southeast of Locus 2. Locus 3 measures 2.7 meters northeast to southwest by 1.5 meters northwest to southeast, and includes 12 jasper flakes (four primary, four secondary, three tertiary, and one shatter) and one jasper tested cobble.

Locus 4 is located within the northern portion of the site, approximately 12 meters north of Locus 3. Locus 4 measures 3.1 meters north to south by 6.3 meters east to west, and includes 18 jasper flakes (seven primary, five secondary, five tertiary, and one shatter) and one jasper tested cobble.

Those artifacts observed outside of the loci total 92 and consist of 33 jasper flakes (eight primary, 12 secondary, and 13 tertiary), 27 red jasper flakes (unreported type), one light green rhyolite flake (unreported type), eight red/caramel banded jasper flakes (unreported type), six caramel jasper flakes (unreported type), three chalcedony flakes (unreported type), five jasper bifacial cores, two jasper multidirectional cores, one red basalt multi-directional core, one rhyolite unidirectional core, one jasper core, one basalt unidirectional core, one jasper edge modified flake, one basalt edge modified flake, and one jasper tested cobble.

The potential for buried artifacts is low as geologic sources indicate the erosional fan remnant dates to the Early-to-Middle Pleistocene (Rogers 1967); however, artifacts associated with portions of the fan surface and desert pavement may be covered by eolian deposits. Nonetheless, because the artifact assemblage identified on site consists of cores, tested cobbles, edge modified flakes, and debitage, all of which are indicative of lithic procurement and initial lithic reduction activities, it is highly likely that any artifacts present in subsurface contexts would mirror those artifact types already identified.

Based upon the cultural constituents and the physical context, archaeologists for the Applicant interpret this site as a lithic procurement and initial lithic reduction locality. The lithic materials appear to be derived from cobbles of toolstone quality found on site within the desert pavement surfaces, and the artifact types identified (unidirectional, bifacial, and multi-directional cores, tested cobbles, edge modified flakes, and a preponderance of cortical debitage) reflect early stage biface reduction. Such artifacts indicate percussion (hard-hammer and/or soft-hammer) reduction (Andrefsky Jr. 2008; Odell 2004; Whittaker 1994). While edge modified flakes are present within the site, they are likely the result of core platform preparation, and not tool manufacturing. Additionally, all four loci identified comprise only one type of lithic material (jasper), suggesting that they are interpreted as single reduction loci. Thus, the site appears to represent a minimum of four episodes or localities of early stage biface reduction.

This site lacks artifacts with unique or temporally diagnostic characteristics, and the material remains cannot be associated with a specific period of prehistory or ethnohistory. The artifact distribution has been documented during the recordation process. Combined site CA-SBR-13444 is situated on the toe slope of a nearly level erosional fan remnant composed of moderate- to well developed desert pavement consisting of moderately sorted sub-angular to sub-rounded coarse sand grains, pebbles, and cobbles. This geomorphic landform indicates an Early-to-Middle Pleistocene (Rogers 1967) period of formation. Because the formation of this landform predates human presence in the area, there is very low likelihood for subsurface archaeological deposits. Therefore, data potential is considered exhausted through recordation of combined site CA-SBR-13444.

CA-SBR-13445

Combined site CA-SBR-13445 combines previously recorded sites CA-SBR-13088 and CA-SBR-13090. CA-SBR-13088 was originally described as a discrete prehistoric lithic scatter, measuring 37 meters north to south by 72 meters east to west, containing 96 cryptocrystalline silicate (jasper and chalcedony) secondary and tertiary flakes, one biface fragment, including four loci with a higher concentration of artifacts. CA-SBR-13090 was originally described as a prehistoric site, measuring 115 meters north to south by 50 meters east to west, containing 214 jasper artifacts (debitage, cores, core tool, scraper, and expedient tool), one andesite flake, including four loci with a higher concentration of artifacts.

Combined site CA-SBR-13445 is an amorphous-shaped moderate density complex lithic scatter that is located within the eastern portion of the Phase 2 area of the Calico Solar Project site and covers a total surface area of 9,291 square meters. The site is situated on a nearly level (1 degree slope) erosional fan remnant facing east, specifically, on a low interfluvial rise separating two west trending braided washes north and south of the site. The erosional fan remnant constitutes the hills and ridges that extend above, and are surrounded by, the other landforms in the southern portion of the Calico Solar Project site. Fan remnants generally are composed of a summit with moderate- to well-developed desert pavement (due to both parent material and age) and erosional side slopes that usually lack pavement. Within the southern Calico Solar Project site, these fan remnants are generally composed of a very old (Early-to-Middle Pleistocene) fanglomerate of cobbles and coarse gravels.

The site surface is covered by a moderate- to well-developed desert pavement consisting of moderately sorted sub-angular to sub-rounded pebbles and cobbles of cryptocrystalline silicates (e.g., jasper, chert, and chalcedony), basalt, and other volcanic materials. The continuity of the pavement is broken by small west northwest trending gullies and small drainage features. Limited eolian deposits consist of small coppice dunes and in-filled gullies that cover less than five percent of the site. Site sediments generally consist of fine to medium grained sand with poorly sorted sub-rounded to sub-angular pebbles and cobbles. The adjacent washes form the upper branches of the axial channel for the valley and converge 1,200 meters northwest of the site area. The remnant fan that the site rests upon extends east and west for several hundred meters in both directions. The Pisgah lava flow is 450 meters to the south. Vegetation in the site area and vicinity is dominated by the Creosote Bush Community which is characteristic of the Mojave Desert where rainfall is less than 19 centimeters annually. Within the site area, observed vegetation includes creosote bush (*Larrea tridentata*) and desert saltbush (*Artiplex polycarpa*).

This complex lithic scatter measures 125 meters north to south by 167 meters east to west, and contains a total of 322 prehistoric artifacts. Artifact density at combined site CA-SBR-13445 is moderate, with a calculated distribution of one artifact per 28.58 square meters. However, 11 discrete loci with higher concentrations of cultural materials do occur within the site area. The overall condition of the site is fair, with the southern edge destroyed due to the proximity of the So Cal Gas pipeline construction corridor. The major physical surface characteristic of this site is a moderate density lithic reduction scatter containing approximately 322 jasper and cryptocrystalline silicate artifacts, which include: 311 jasper flakes (86 primary, 189 secondary, 23 tertiary, and 13 shatter), four mustard cryptocrystalline silicate secondary flakes, four jasper cores (one bifacial, two multi-directional, and one unreported core type), one multi-directional core tool, one expedient flake tool, and one unifacial scraper. Of the 322 artifacts identified, 308 artifacts occur within 11 discrete loci (i.e., Loci 1-11) with higher concentrations of artifacts situated on moderately-developed desert pavement surfaces; the remaining cultural materials identified occur outside of these designated loci.

Locus 1 is located along the southeastern site boundary, measures 4.75 meters north to south by 7.1 meters east to west, and contains 45 cryptocrystalline silicate jasper flakes (30 primary and 15 secondary).

Locus 2 is located along the central-southern site boundary, approximately 32 meters west of Locus 1. Locus 2 measures 1.0 meter north to south by 2.0 meters east to west, and contains six primary cryptocrystalline silicate jasper flakes.

Locus 3 is located along the northeastern site boundary, approximately 57 meters northeast of Locus 2. Locus 3 measures 1.0 meter north to south by 1.0 meter east to west, and contains six cryptocrystalline silicate jasper flakes (three primary and three secondary).

Locus 4 is located along the eastern site boundary, approximately 22 meters southeast of Locus 3. Locus 4 measures 4.3 meters north to south by 2.0 meters east to west, and contains 26 cryptocrystalline silicate jasper flakes (six primary, 10 secondary and 10 tertiary).

Locus 5 is located within the central portion of the site, approximately 101 meters west of Locus 4. Locus 5 measures 12.0 meters north to south by 11.0 meters east to west, and contains 86 cryptocrystalline silicate jasper flakes (nine primary and 77 secondary), one multi-directional jasper core tool, and one multi-directional jasper core.

Locus 6 is located along the southwestern site boundary, approximately 10 meters west of Locus 5. Locus 6 measures 3.5 meters north to south by 4.0 meters east to west, and contains 20 cryptocrystalline silicate jasper flakes (three primary and 17 secondary).

Locus 7 is located within the central-western portion of the site, approximately 28 meters northwest of Locus 6. Locus 7 measures 3.0 meters north to south by 7.0 meters east to west, and contains 38 cryptocrystalline silicate jasper flakes (eight primary and 30 secondary).

Locus 8 is located along the northern site boundary, approximately 63 meters northeast of Locus 7. Locus 8 measures 4.0 meters north to south by 3.5 meters east to west, and contains 22 cryptocrystalline silicate jasper flakes (seven primary and 15 secondary), one multi-directional jasper core, and one bifacial jasper core.

Locus 9 is located along the central-eastern site boundary, approximately 63 meters southeast of Locus 8. Locus 9 measures 5.5 meters northeast to southwest by 3.0 meters northwest to southeast, and contains 22 cryptocrystalline silicate jasper flakes (two primary, seven secondary, seven tertiary, and six shatter).

Locus 10 is located along the central-western site boundary, approximately 41 meters west of Locus 9. Locus 10 measures 2.5 meters north to south by 4.0 meters east to west, and contains 25 cryptocrystalline silicate jasper flakes (10 primary, 11 secondary, and four shatter).

Locus 11 is located along the northwestern site boundary, approximately 63 meters north of Locus 10. Locus 11 measures 1.0 meter northeast to southwest by 3.0 meters northwest to southeast, and contains eight cryptocrystalline silicate jasper flakes (two secondary, three tertiary, and three shatter).

Those artifacts observed outside of the loci consist of seven cryptocrystalline silicate jasper flakes (two primary, two secondary, and three tertiary), four mustard cryptocrystalline silicate secondary flakes, one jasper core, one jasper expedient flake tool, and one jasper unifacial scraper.

The potential for subsurface deposits on the fan remnant is low, as geologic sources indicate the fan remnant dates to the Early-to-Middle Pleistocene; however, some intact desert pavement may be covered by eolian deposits. Nonetheless, because the artifact assemblage identified on site consists of cores, a core tool, a flake tool, a scraper, and debitage, all of which are indicative of lithic procurement and early to-late stage lithic reduction activities, it is highly likely that any artifacts present in subsurface contexts would mirror those artifact types already identified.

Based upon the cultural constituents and the physical context, archaeologists for the Applicant interpret this site as a lithic procurement and early-to-late stage lithic reduction locality. The lithic materials appear to be derived from cobbles of toolstone quality found on site within the desert pavement surfaces, and the artifact types identified (bifacial and multi-directional cores, a multi-directional core tool, and a preponderance of cortical debitage) reflect early stage biface reduction. Such artifacts indicate percussion (hard-hammer and/or soft-hammer) reduction (Andrefsky Jr. 2008; Odell 2004; Whittaker 1994). The presence of the expedient flake and unifacial scraper also suggest that later stage reduction activities were also undertaken at the site. Additionally, all 11 loci identified include only one type of lithic material (jasper), suggesting that they are single reduction loci.

Because this site lacks artifacts with unique or temporally diagnostic characteristics, the material remains cannot be associated with a specific period of prehistory or ethnohistory. Additionally, this site cannot reliably be associated with any distinctive or significant event, person, design, or construction, and the artifact distribution has been documented during the recordation process. Combined site CA-SBR-13445 is situated on a nearly level erosional fan remnant with an Early-to-Middle Pleistocene period of formation. Because the formation of this landform predates human presence in the area, there is very low likelihood for subsurface archaeological deposits. Therefore, data potential is considered exhausted through recordation of combined site CA-SBR-13445.

P36-014519

P36-014519, a rock cairn covering a total surface area of (25 square feet) (ft^2), is situated on the fan skirt near the base of the alluvial fan piedmont. The alluvial fan piedmont is the large, gently sloping depositional feature that is commonly referred to as a “bajada.” The general area is nearly flat and faces west southwest. Coarse sub-angular grains of sand and small pebbles moderately cover the surface suggesting wind erosion is actively affecting the site surface by removing the finer fraction of the surficial sediments, which implies some degree of surface stability. Larger clast are sparsely scattered throughout the general area and are likely from the Pisgah lava flow 250 meters southwest. A braided stream is located 60 to 70 meters south. Vegetation in the site area and vicinity is dominated by the Creosote Bush Community which is characteristic of the Mojave Desert where rainfall is less than 19 centimeters annually. Within the site area, observed vegetation includes creosote bush (*Larrea tridentata*), burrobush (*Ambrosia dumosa*), and desert saltbush (*Artiplex polycarpa*), as well as bunch grasses that were unidentifiable during the archaeological survey.

P36-014519 is a partially deflated rock cairn that measures 5 feet north to south by 5 feet east to west by 19 inches high and contains two layers of a total of 31 small to large sub-rounded to sub-angular metavolcanic cobbles. Due to the location of the cairn, it is not possible to determine if it is historic or prehistoric in origin. However, this site and site P36-014520, another isolated rock cairn, are located less than 1 foot from being exactly 400 feet apart; both are located approximately 25 meters northeast of the former alignment of the Old National Trails Highway/Historic Route 66 (CA-SBR-2910H). The placement of the cairns and absence of known mining deposits in the area indicates that these cairns are likely associated with the highway and may have been land surveying monuments. San Bernardino County was responsible for route planning at the time the Old National Trails Highway was designated, and the route may or may not have been professionally engineered. No historical "as built" drawings of the highway have been located; thus, the Applicant cannot make a direct association between the rock cairns and the highway. It should also be noted that no prehistoric or historical artifacts are present on the surface within the vicinity of the cairn. Although site recordation involved only an examination of the site surface, the potential for buried prehistoric or historical artifacts at this site is low due to eolian deflation of the site sediments.

The cairn feature at P36-014519 has been documented during the recordation process, and the data potential is considered exhausted through recordation of P36-014519.

C.4 – GEOLOGY AND PALEONTOLOGY

Testimony of Dal Hunter, Ph.D., C.E.G.

C.4.1 SUMMARY OF CONCLUSIONS

The proposed Calico Solar Project (formerly the Stirling Energy Systems Solar One Project) site is located in an active geologic area of the north-central Mojave Desert Geomorphic Province in central San Bernardino County in south-central California. Because of its geologic setting, the site could be subject to intense levels of earthquake-related ground shaking. The effects of strong ground shaking would need to be mitigated, to the extent practical, through structural designs required by the California Building Code (CBC 2007) and the project geotechnical report. The CBC (2007) requires that structures be designed to resist seismic stresses from ground acceleration and, to a lesser extent, liquefaction. A geotechnical investigation has been performed and presents standard engineering design recommendations for mitigation of seismic shaking and site soil conditions.

There are no known viable geologic or mineralogical resources at the proposed Calico Solar Project site. Locally, paleontological resources have been documented within older Quaternary alluvium which underlies the younger Quaternary alluvium of the site surface. Potential impacts to paleontological resources would be mitigated through worker training and monitoring by qualified paleontologists, as required by Conditions of Certification, **PAL-1** through **PAL-7**.

Based on its independent research and review, California Energy Commission and U.S. Bureau of Land Management staff believes that the potential is low for significant adverse impacts to the proposed project from geologic hazards during its design life and to potential geologic, mineralogic, and paleontological resources from the construction, operation, and closure of the proposed project. It is staff's opinion that the Calico Solar Project could be designed and constructed in accordance with all applicable laws, ordinances, regulations, and standards and in a manner that both protects environmental quality and assures public safety, to the extent practical. Implementation and enforcement of the proposed conditions of certification should result in less than significant impacts to geology and paleontology.

C.4.2 INTRODUCTION

In this section, California Energy Commission (Energy Commission) and U.S. Bureau of Land Management (BLM) staff discusses the potential impacts of geologic hazards on the proposed Calico Solar Project as well as the project's potential impacts on geologic, mineralogic, and paleontological resources. Staff's objective is to ensure that there would be no consequential adverse impacts to significant geological and paleontological resources during project construction, operation, and closure and that operation of the plant would not expose occupants to high-probability geologic hazards. A brief geological and paleontological overview is provided. The section concludes with staff's proposed monitoring and mitigation measures for geologic hazards and geologic, mineralogic, and paleontological resources, with proposed conditions of certification.

C.4.3 METHODOLOGY AND THRESHOLDS FOR DETERMINING ENVIRONMENTAL CONSEQUENCES

Federal agencies are required to review major federal actions such as the Calico Solar Project under the National Environmental Policy Act (NEPA). This document has been prepared in consultation and coordination with the BLM to also address federal environmental issues. The BLM and CEC have conducted a joint environmental review of the project in a single NEPA/California Environmental Quality Act (CEQA) process. The Federal Land Policy and Management Act of 1976 (FLPMA) establishes the agency's multiple-use mandate to serve present and future generations.

The CEQA Guidelines, Appendix G, provide a checklist of questions that lead agencies typically address.

- Section (V) (c) includes guidelines that determine if a project will either directly or indirectly destroy a unique paleontological resource or site or a unique geological feature.
- Sections (VI) (a), (b), (c), (d), and (e) focus on whether or not the project would expose persons or structures to geological hazards.
- Sections (X) (a) and (b) concern the project's effects on mineral resources.

The California Building Standards Code (CBSC) and CBC (2007) provide geotechnical and geological investigation and design guidelines, which engineers must follow when designing a facility. As a result, the criteria used to assess the significance of a geological hazard include evaluating each hazard's potential impact on the design and construction of the proposed facility. Geological hazards include faulting and seismicity, volcanic eruptions, liquefaction, dynamic compaction, hydrocompaction, subsidence, expansive soils, landslides, tsunamis, and seiches. Of these, dynamic compaction, hydrocompaction, subsidence, and expansive soils are geotechnical engineering issues but are not normally associated with concerns for public safety.

Staff has reviewed geological and mineral resource maps for the surrounding area, as well as site-specific information provided by the applicant, to determine if any geological and mineralogical resources exist in the area and to determine if operations could adversely affect such geological and mineralogical resources.

To evaluate whether the proposed project and alternatives would generate a potentially significant impact as defined by CEQA on mineral resources, the staff evaluated them against checklist questions posed in the 2006 CEQA Guidelines, Appendix G, Environmental Checklist established for Mineral Resources. These questions are:

A. Would the project result in the loss of availability of a known mineral resource that would be of value to the region and residents of the state?

B. Would the project result in the loss of availability of a locally-important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan?

Under NEPA, the impact of the proposed project and alternatives on mineral resources would be considered significant if they would directly or indirectly interfere with active mining claims or operations, or would result in reducing or eliminating the availability of important mineral resources. The staff's evaluation of the significance of the impact of the proposed project on mineral resources includes an assessment of the context and intensity of the impacts, as defined in the NEPA implementing regulations 40 CFR Part 1508.27.

Staff reviewed existing paleontological information and requested records searches from the San Diego Natural History Museum (SDNHM) and the Natural History Museum of Los Angeles County (LACM) for the site area. Site-specific information generated by the applicant for the Calico Solar Project was also reviewed. All research was conducted in accordance with accepted assessment protocol (SVP 1995) to determine whether any known paleontological resources exist in the general area. If present or likely to be present, conditions of certification which outline required procedures to mitigate impacts to potential resources are proposed as part of the project's approval.

The Antiquities Act of 1906 (16 United States Code [USC]) requires that objects of antiquity be taken into consideration for federal projects and the CEQA, Appendix G, also requires the consideration of paleontological resources. The Paleontological Resources Preservation Act of 2009 requires the Secretaries of the United States Department of the Interior and Agriculture to manage and protect paleontological resources on Federal land using scientific principles and expertise. The potential for discovery of significant paleontological resources or the impact of surface disturbing activities to such resources is assessed using the Potential Fossil Yield Classification (PFYC) system. The PFYC class ranges from Class 5 (very high) to Class 1 (very low) (USDI 2007). The formerly used system, replaced by the PFYC system in 2009, assigned one of three conditions: Condition 1 (areas known to contain vertebrate fossils), Condition 2 (areas with exposures of geological units or settings that have high potential to contain vertebrate fossils); and Condition 3 (areas that are very unlikely to produce vertebrate fossils); due to the recency of this change, information from the previous system is included in the analysis as well.

The proposed conditions of certification allow BLM's Authorized Officer, the Energy Commission's compliance project manager (CPM) and the applicant to adopt a compliance monitoring scheme ensuring compliance with laws, ordinances, regulations, and standards (LORS) applicable to geological hazards and the protection of geologic, mineralogic, and paleontological resources.

Based on the information below, it is staff's opinion that the potential for significant adverse impacts to the project from geological hazards, and to potential geologic, mineralogic, and paleontological resources from the proposed project is low.

LAWS, ORDINANCES, REGULATIONS, AND STANDARDS

Applicable LORS are listed in the application for certification (AFC) (SES 2008a). The following briefly describes the current LORS for both geologic hazards and resources and mineralogical and paleontological resources.

Geology and Paleontology Table 1
Laws, Ordinances, Regulations, and Standards (LORS)

Applicable Law	Description
Federal	
Antiquities Act of 1906 (16 United States Code [USC], 431-433	The proposed Calico Solar Project is located entirely on federal (Bureau of Land Management) land. Although there is no specific mention of natural or paleontological resources in the Act itself, or in the Act's uniform rules and regulations (Title 43 Part 3, Code of Federal Regulations [43 CFR Part 3], 'objects of antiquity' has been interpreted to include fossils by the Federal Highways Act of 1956, the National Park Service (NPS), the Bureau of Land Management (BLM), the Forest Service (USFS), and other Federal agencies. All design will also need to adhere to any applicable BLM design standards.
Antiquities Act of 1906 (16 United States Code [USC], 431-433)	The proposed Calico Solar Project facility site is located entirely on land currently administered by the Bureau of Land Management (BLM). Although there is no specific mention of natural or paleontological resources in the Act itself, or in the Act's uniform rules and regulations (Title 43 Part 3, Code of Federal Regulations [43 CFR Part 3], 'objects of antiquity' has been interpreted to include fossils by the Federal Highways Act of 1956, the National Park Service (NPS), the BLM, the Forest Service (USFS), and other Federal agencies.
National Environmental Policy Act (NEPA) of 1970 (42 USC 4321, et. seq.)	Established the Council on Environmental Quality (CEQ), which is charged with preserving 'important historic, cultural, and natural aspects of our national heritage'.
Federal Land Policy and Management Act (FLPMA) of 1976 (43 USC 1701-1784)	Authorizes the BLM to manage public lands to protect the quality scientific, scenic, historical, archeological, and other values, and to develop 'regulations and plans for the protection of public land areas of critical environmental concern', which include 'important historic, cultural or scenic values'. Also charged with the protection of 'life and safety from natural hazards'.
Paleontological Resources Preservation Act (PRPA) (Public Law [PL] 111-011)	Authorizes Departments of Interior and Agriculture Secretaries to manage the protection of paleontological resources on Federal lands.
State	
California Building Code (CBC), 2007	The CBC (2007) includes a series of standards that are used in project investigation, design, and construction (including grading and erosion control).
Alquist-Priolo Earthquake Fault Zoning Act, Public Resources Code (PRC), Section 2621–2630	Mitigates against surface fault rupture of known active faults beneath occupied structures. Requires disclosure to potential buyers of existing real estate and a 50-foot setback for new occupied buildings. Portions of the site and proposed ancillary facilities are located within designated Alquist-Priolo Fault Zones. The proposed site layout places occupied structures outside of the 50-foot setback zone.

Applicable Law	Description
The Seismic Hazards Mapping Act, PRC Section 2690–2699	Areas are identified that are subject to the effects of strong ground shaking, such as liquefaction, landslides, tsunamis, and seiches.
PRC, Chapter 1.7, Sections 5097.5 and 30244	Regulates removal of paleontological resources from state lands, defines unauthorized removal of fossil resources as a misdemeanor, and requires mitigation of disturbed sites.
Warren-Alquist Act, PRC, Sections 25527 and 25550.5(i)	The Warren-Alquist Act requires the Energy Commission to “give the greatest consideration to the need for protecting areas of critical environmental concern, including, but not limited to, unique and irreplaceable scientific, scenic, and educational wildlife habitats; unique historical, archaeological, and cultural sites…” With respect to paleontological resources, the Energy Commission relies on guidelines from the Society of Vertebrate Paleontology, indicated below.
California Environmental Quality Act (CEQA), PRC sections 15000 et seq., Appendix G	Mandates that public and private entities identify the potential impacts on the environment during proposed activities. Appendix G outlines the requirements for compliance with CEQA and provides a definition of significant impacts on a fossil site.
Society of Vertebrate Paleontology (SVP), 1995	The “Measures for Assessment and Mitigation of Adverse Impacts to Non-Renewable Paleontological Resources: Standard Procedures” is a set of procedures and standards for assessing and mitigating impacts to vertebrate paleontological resources. The measures were adopted in October 1995 by the SVP, a national organization of professional scientists.
Local	
San Bernardino County 2007 Development Code, Chapters 82.15, 82.20 and Safety Element	Chapter 82.15 requires that a geological study will be undertaken where roads and structures are to be constructed. Also requires that roads and utilities will be perpendicular to faults. Chapter 82.20 defines criteria for site evaluation for paleontological resources in the county, including preliminary field surveys, monitoring during construction, and specimen recovery; also defines qualifications for professional paleontologists. The Safety Element requires compliance with geological/geotechnical reports, the CBC, and other state agencies and regulations.

C.4.4 PROPOSED PROJECT

C.4.4.1 SETTING AND EXISTING CONDITIONS

The proposed Calico Solar Project would be constructed on 8,230 acres north of Interstate Highway 40 (I-40) in San Bernardino County, California. The property is located entirely on public land managed by the BLM. The site is approximately 115 miles east of Los Angeles, 37 miles east of Barstow, 17 miles east of Newberry Springs, and 57 miles northeast of Victorville. The historic mining town of Hector and the Hector Road interchange on I-40 are adjacent to the property (URS 2008). The Burlington

Northern Santa Fe railroad tracks parallel I-40 and cross the site, but the right-of-way (ROW) is excluded from the property. Within the overall project boundaries, 3 areas totaling approximately 2,240 acres are excluded from the project site.

The proposed Calico Solar Project would be a primary power generating facility capable of producing 850 megawatts (MW) of electricity, and would be constructed in two phases. The original Phase I identified in the AFC called for construction of a 500-MW facility on 5,838 acres with Phase II generating an additional 350 MW from the remaining 2,392 acres (URS 2008).

However, the applicant subsequently revised the project to align the output of Phase I with the capacity of the Southern California Edison (SCE) transmission system prior to the completion of a 500-kilovolt (kV) upgrade to the Lugo-Pisgah Transmission line. Although the newly defined Phase I would not require the replacement of the existing 220-kV Lugo-Pisgah transmission line with a new 500-kV line, Phase I would require upgrades to the SCE Pisgah Substation and communication systems.

The new Phase I would be limited to 275 MW, with the remaining 575 MW as part of the newly defined Phase II. Power would be generated by up to 34,000 SunCatcher solar dish collectors which would be supported on individual metal pipe or drilled pier foundations. Each SunCatcher is capable of generating 25 kilowatts (kW) of grid-quality electricity and consists of a 38-foot by 40-foot dish array of mirrors that automatically focus sunlight onto a power conversion unit (PCU). The PCU consists of a heat exchanger and closed-cycle, high-efficiency Solar Stirling Engine that utilizes heated hydrogen gas to drive a rotary generator and produce electricity.

Supporting facilities would include an operations and administration building, a maintenance building, a new 230-kW substation, a satellite services complex and main services complex. Water for the project would be provided by a new well and demineralized for washing the mirrors. Waste water from this process would be disposed of by evaporation from two concrete-lined ponds that would have a combined capacity of 2 million gallons. On-site ancillary facilities associated with the solar array would include buried water pipe lines, and a roughly 2-mile-long 220-kV electrical transmission line connecting the new substation to the existing SCE Pisgah Substation just off the southern and eastern end of the site. The Pisgah Substation would require upgrades to accept power from the Calico Solar Project, and demolition and upgrade of 65 miles of the existing Lugo-Pisgah No. 2, 220-kV transmission line. Off-site upgrades are not a part of the Calico Solar Project, but are addressed in **Section C.4.8** as reasonably foreseeable impacts.

Regional Setting

The proposed site is located in the central portion of the Mojave Desert physiographic province in Southern California. The Mojave Desert is a broad interior region of isolated mountain ranges which separate vast expanses of desert plains and interior drainage basins and occupies approximately 25,000 square miles in southeastern California and portions of Nevada, Utah, and Arizona. In California, its overall topography is dominated by southeast to northwest-trending faulting with a secondary east-to-west-trending alignment which is attributable to Transverse Range faulting.

Project Site Description

The proposed Calico Solar Project would be constructed on 8,230 acres north of Interstate Highway 40 (I-40) in San Bernardino County, California. The potential site is located within the structurally defined Eastern California Shear Zone (ECSZ). The property lies on the southwest flank of the Cady Mountains on federal land managed by the BLM. Overall the site slopes southwest toward the local topographic low at the normally dry Troy Lake.

Surface cover at the site consists of Quaternary alluvium and fanglomerate composed of sediments washed down from the Cady Mountains to the northeast. Small outcrops of Tertiary basalt, andesite, and volcanic breccia occur in the northernmost portion of the site. A small outcrop of basalt flow from the geologically recent Pisgah Crater eruption is present along the southernmost site boundary.

C.4.4.2 ASSESSMENT OF IMPACTS AND DISCUSSION OF MITIGATION

This section considers two types of impacts. The first is geologic hazards, which could impact the proper functioning of the proposed facility and create life/safety concerns. The second is the potential impacts the proposed facility could have on existing geologic, mineralogic, and paleontological resources in the area.

Direct/Indirect Impacts and Mitigation

Ground shaking represents the main geologic hazard at this site. The effect of this potential hazard on the project can be effectively mitigated through facility design by incorporating recommendations contained in the project geotechnical report and the CBC (2007). Proposed Conditions of Certification **GEN-1, GEN-5,** and **CIVIL-1** in the **Facility Design** section should also mitigate these potential impacts to a less than significant level.

The proposed Calico Solar Project site is not located within an established Mineral Resource Zone (MRZ) and no economically viable mineral deposits are known to be present at the site.

Near-surface geology beneath the site consists primarily of Quaternary alluvium and fanglomerate overlying Quaternary older alluvium with minor outcrops of Tertiary volcanic rocks (Dibblee 2008). Staff reviewed correspondence from the NHMLA (McLeod 2009) and the project confidential paleontological resources technical report (URS 2008) for information regarding known fossil localities and stratigraphic unit sensitivity within the project area. The LACM has recorded 2 fossil localities (camel and horse) within the Cady Mountains northeast of the project area and ancillary facilities. The project confidential paleontological resources technical report indicates the presence of 2 fossil collection sites (fossil types not stated) within the project boundaries. Also noted were the presence of silicified root masses and possible burrow structures. No major fossil finds have occurred within 2 miles of the project site.

Based on the recorded fossil finds, staff concludes the Quaternary alluvium and fanglomerate have low potential to produce fossils. Quaternary older alluvium has moderate paleontological resource sensitivity. Tertiary volcanic rocks also have a very low potential to produce fossils.

Overall, staff considers the probability for significant paleontological resources to be encountered during site construction activities to be low. However, if construction includes significant amounts of grading or deep foundation excavation and utility trenching the potential for exposure of paleontological resources will increase with depth of the excavations. This assessment is based on SVP criteria and the paleontological report appended to the AFC (SES 2008a). Low paleontological sensitivity roughly corresponds to PFYC Class 1 or 2 (Condition 3). Deeper excavations could potentially encounter a high sensitivity formation of PFYC Class 4 (Condition 2). Proposed Conditions of Certification **PAL-1** to **PAL-7** are designed to mitigate paleontological resource impacts, as discussed above, to less than significant levels. These conditions essentially require a worker education program in conjunction with the monitoring of earthwork activities by a qualified professional paleontologist (a paleontological resource specialist, or PRS).

The proposed conditions of certification allow the Energy Commission's compliance project manager (CPM) and the applicant to adopt a compliance monitoring scheme ensuring compliance with LORS applicable to geologic hazards and the protection of geologic, mineralogic, and paleontological resources.

Based on the information below, it is staff's opinion that the potential for significant adverse, direct or indirect impacts to the project, from geologic hazards, and to potential geologic, mineralogic, and paleontological resources, from the proposed project, is low.

<u>Geological Hazards</u>

The AFC provides documentation of potential geologic hazards at the proposed Calico Solar Project plant site, including limited site-specific subsurface information (SES 2008a). Review of the AFC, coupled with staff's independent research, indicates that the potential for geologic hazards to impact the proposed plant site during its practical design life is low if recommendations for mitigation of seismic shaking are followed. Geologic hazards related to seismic shaking are addressed in the project geotechnical report per CBC (2007) requirements (SES 2008a).

Staff's independent research included the review of available geologic maps, reports, and related data of the Calico Solar Project site. Geological information was available from the California Geological Survey (CGS), California Division of Mines and Geology (CDMG, now known as CGS), the U.S. Geological Survey (USGS), the American Geophysical Union, the Geologic Society of America, and other organizations.

Faulting and Seismicity

Energy Commission staff reviewed numerous CDMG and USGS publications as well as informational websites in order to gather data on the location, recency, and type of faulting in the project area. Type A and B faults within 80 miles of the proposed Calico Solar Project site are listed in Table 2. Type A faults have slip-rates of ≥5 mm per year and are capable of producing an earthquake of magnitude 7.0 or greater. Type B faults have slip-rates of 2 to 5 mm per year and are capable of producing an earthquake of magnitude 6.5 to 7.0. The fault type, potential magnitude, and distance from the site are summarized in **Geology and Paleontology Table 2**. Because of the large size of the site the distances to faults are measured from the proposed control building location within the project boundaries.

Geology and Paleontology Table 2
Active Faults Relative to the Proposed Calico Solar Project Site

Fault Name	Distance From Site (miles)	Maximum Earthquake Magnitude (Mw)	Estimated Peak Site Acceleration (g)	Movement and Strike	Slip Rate mm/yr	Fault Type
Lavic Lake	1.5	7.1		Right-Lateral Strike Slip (Northwest)	0.2 - 1	B
Pisgah-Bullion Mtn. - Mesquite Lake	4.1	7.3	0.391	Right-Lateral Strike Slip (Northwest)	0.6	B
Calico - Hidalgo	11.4	7.3	0.210	Right-Lateral Strike Slip (Northwest)	0.6	B
Landers	18.8	7.3	0.146	Right-Lateral Strike Slip (Northwest)	0.6	B
Emerson South – Copper Mtn.	20.9	7.0	0.115	Right-Lateral Strike Slip (Northwest)	0.6	B
Johnson Valley (Northern)	24.4	6.7	0.087	Left-Lateral Strike Slip (Northwest)	0.6	B
Lenwood – Lockhart – Old Woman Springs	26.7	7.5	0.124	Right-Lateral Strike Slip (Northwest)	0.6	B
Gravel Hills – Harper Lake	29.9	7.1	0.092	Right-Lateral Strike Slip (Northwest)	0.6	B
Northern Frontal Fault Zone (East)	35.2	6.7	0.080	Reverse (South)	0.5	B
Blackwater	38.2	7.1	0.076	Right-Lateral Strike Slip (Northwest)	0.6	B
Northern Frontal Fault Zone (West)	39.7	7.2	0.095	Reverse (South)	1.0	B
Helendale – South Lockhart	40.1	7.3	0.082	Right-Lateral Strike Slip (Northwest)	0.6	B
Pinto Mountain	46.3	7.2	0.069	Left-Lateral Strike Slip (Northwest)	2.5	B
Burnt Mountain	47.4	6.5	0.047	Right-Lateral Strike Slip (Northwest)	0.6	B
Eureka Peak	47.4	6.4	0.045	Right-Lateral Strike Slip (Northwest)	0.6	B
Garlock (East)	53.9	7.5	0.072	Left-Lateral Strike Slip (Northeast)	7.0	B
Death Valley (South)	54.2	7.1	0.058	Right-Lateral Strike Slip (Northwest)	4.0	B
Cleghorn	58.4	6.5	0.040	Right-Lateral Strike Slip (Northwest)	0.6	B
San Andreas – San Bernardino M-1	60.3	7.5	0.066	Right-Lateral Strike Slip (Northwest)	24.0	A
San Andreas – San Bernardino – Coachella M-1b-2	60.3	7.7	0.073	Right-Lateral Strike Slip (Northwest)	24.0	A
San Andreas – Whole M-1a	60.3	8.0	0.086	Right-Lateral Strike Slip (Northwest)	34.0	A
San Andreas – San Bernardino – Coachella M-2b	60.3	7.7	0.073	Right-Lateral Strike Slip (Northwest)	25.0	A
San Andreas – Coachella M-1c-5	61.4	7.2	0.056	Right-Lateral Strike Slip (Northwest)	25.0	A
Owl Lake	61.5	6.5	0.038	Left-Lateral Strike Slip (Northwest)	2.0	B
Panamint Valley	62.6	7.4	0.061	Right-Lateral, Normal, Oblique	2.5	B
San Andreas – Cholame – Mojave M-1b-1	72.0	7.8	0.067	Right-Lateral Strike Slip (Northwest)	34.0	A
San Andreas – Mojave	72.0	7.4	0.055	Right-Lateral Strike	30.0	A

Fault Name	Distance From Site (miles)	Maximum Earthquake Magnitude (Mw)	Estimated Peak Site Acceleration (g)	Movement and Strike	Slip Rate mm/yr	Fault Type
M-1c-3				Slip (Northwest)		
Cucamonga	72.2	6.9	0.051	Reverse (North)	5.0	B
San Jacinto – San Bernardino	72.3	6.7	0.038	Right-Lateral Strike Slip (Northwest)	12.0	A
San Jacinto – San Jacinto Valley	72.4	6.7	0.042	Right-Lateral Strike Slip (Northwest)	12.0	A
Tank Canyon	75.3	6.4	0.038	Normal (West)	1.0	B
San Jacinto - Anza	79.5	7.2	0.046	Right-Lateral Strike Slip (Northwest)	12.0	A

In addition to the Type A and B faults, two other faults systems which have potential to cause ground shaking at the proposed Calico Solar Project site are the Cady Fault and the Ludlow Fault. The Cady Fault is an east-west-trending left-lateral strike-slip fault within the Cady Mountains approximately 3 miles north of the northern site boundary. Quaternary movement has been documented on the Cady Fault where it offsets Older alluvium. Younger alluvium covers the eastern end of the Cady Fault suggesting no recent movement. The Ludlow Fault is a northwest-trending right-lateral strike-slip fault which extends to within approximately 12 miles of the eastern boundary of the proposed project site. Quaternary movement has been reported for the Ludlow Fault (SCEC 2009).

Other Type C and otherwise undifferentiated faults which are more than 20 miles from the proposed site are not discussed here because they are unlikely to undergo movement or generate seismicity which could affect the project.

The potential site is located within a structural area variously referred to in literature as the Barstow-Bristol trough (Glazner, Bartley, and Sanner 2000), the Eastern California Shear Zone (Dokka and Travis 1990), and the Mojave Extensional Belt (Ross 1995). All refer, fully or in part, to an area of the Mojave Desert geomorphic province (the Mojave Desert block) which is characterized by northwest-trending right-lateral strike-slip faulting which has accounted for approximately 40 miles of extensional faulting within the region since the middle Miocene (roughly 15 million years ago).

Thirty-two Type A and B faults and fault segments were identified within 80 miles of the potential site (**Geology and Paleontology Table 2).** Of these, two are in close enough proximity to the proposed project site to warrant detailed discussion. These are the Lavic Lake and Pisgah-Bullion fault zones, both of which are designated Alquist-Priolo Earthquake Fault Zones (CDMG 2003). These are subparallel Type B right-lateral northwest-trending strike-slip fault systems which extend beneath the southern portions of the site (USGS 2003). Lack of surface expression north of Interstate 40 precludes mapping of these faults across the proposed site. The Hector Mine M_w 7.1 earthquake of October 16, 1999 occurred along the apparent strike of both of these faults approximately 18 miles south of the proposed Calico Solar Project area. This earthquake resulted in horizontal slip over an estimated 28 miles with a maximum displacement of approximately 17 feet (Trieman et al. 2002). An unnamed M_w 5.1 earthquake occurred within the proposed project boundaries near the northern end of the Pisgah-Bullion fault zone, approximately 1 mile west of the proposed control building site, on December 16, 2008 (SCEC 2009).

No movement along the faults was recorded within the proposed project area during the Hector Mine earthquake. However, damage did occur at Interstate Highway 40, and along the Burlington Northern and Santa Fe Railway, both of which parallel the southern site boundary. Highway damage was considered to be minor and primarily resulted from pounding of bridge decks against bridge barriers, abutments, and wingwalls (Yashinsky, et al. 2002). Railroad damage included derailment of an Amtrak passenger train, displacement of ballast from cribbing, and buckling of tracks (Byers 2000).

The potential for actual fault-related ground rupture at the proposed Calico Solar Project is considered very low, but evidence of Holocene movement has been found on nearly every major fault in the ECSZ (Trieman et al. 2002). Events such as the Hector Mine earthquake and the unnamed earthquake of December 16, 2008 show the proposed site could be subject to intense levels of earthquake-related ground shaking in the future. The effects of strong ground shaking would need to be mitigated, to the extent practical, through structural designs required by the CBC (2007) and the project geotechnical report. The CBC (2007) requires that structures be designed to resist seismic stresses from ground acceleration and, to a lesser extent, liquefaction. A geotechnical investigation has been performed and presents standard engineering design recommendations for mitigation of seismic shaking and site soil conditions (URS 2008). Based on the apparent soil profile beneath the proposed Calico Solar Project site, the site soil class is assumed to be seismic Class D. The estimated peak horizontal ground acceleration for the power plant is 0.74 times the acceleration of gravity (0.74g) for bedrock acceleration based on 2% probability of exceedence in 50 years under 2007 CBC criteria. For a Class D site, the soils profile amplifies the potential acceleration of the ground surface to 1.94g (USGS 2008a)

Liquefaction

Liquefaction is a condition in which a saturated cohesionless soil may lose shear strength because of sudden increase in pore water pressure caused by an earthquake. However, the potential for liquefaction of strata deeper than approximately 40 feet below surface is considered negligible due to the increased confining pressure and because geologic strata at this depth are generally too compact to liquefy. The reported deep ground water table (greater than 300 feet) would indicate no potential for liquefaction. Soil characteristics reported in the project-specific geotechnical report (URS 2008) indicate strata beneath the site are also generally too dense to liquefy. Liquefaction potential on the Calico Solar Project site was addressed in the project geotechnical report per CBC (2007) and proposed Condition of Certification **GEN-1** requirements.

Lateral Spreading

Lateral spreading of the ground surface can occur within liquefiable beds during seismic events. Lateral spreading generally requires an abrupt change in slope—that is, a nearby steep hillside or deeply eroded stream bank, etc.—but can also occur on gentle slopes such as are present at the project site. Other factors such as distance from the epicenter, magnitude of the seismic event, and thickness and depth of liquefiable layers also affect the amount of lateral spreading. Because the proposed Calico Solar Project site is not subject to liquefaction, there is no potential for lateral spreading during seismic events.

Dynamic Compaction

Dynamic compaction of soils results when relatively unconsolidated granular materials experience vibration associated with seismic events. The vibration causes a decrease in soil volume, as the soil grains tend to rearrange into a more dense state (an increase is soil density). The decrease in volume can result in settlement of overlying structural improvements. Site specific geotechnical investigation indicates the alluvial deposits in the site subsurface are generally too dense to allow significant dynamic compaction (URS 2008).

Hydrocompaction

Hydrocompaction (also known as hydro-collapse) is generally limited to young soils that were deposited rapidly in a saturated state, most commonly by a flash flood. The soils dry quickly, leaving an unconsolidated, low density deposit with a high percentage of voids. Foundations built on these types of compressible materials can settle excessively, particularly when landscaping irrigation dissolves the weak cementation that is preventing the immediate collapse of the soil structure. Site specific geotechnical investigation indicates the subsurface alluvial deposits which underlie the site are generally too dense to experience significant hydrocompaction (URS 2008).

Subsidence

Local subsidence or settlement may occur when areas containing compressible soils are subjected to foundation or fill loads. Site-specific geotechnical investigation indicates the alluvial deposits which underlie the site are generally at a medium-dense to very dense consistency and therefore are considered unlikely to cause excessive settlement (subsidence) due to foundation loading.

Regional ground subsidence is typically caused by petroleum or ground water withdrawal that increases the effective unit weight of the soil profile, which in turn increases the effective stress on the deeper soils. This results in consolidation or settlement of the underlying soils. No petroleum or natural gas withdrawals are taking place in the site vicinity and ground water pumping for day-to-day site operations would be low and unlikely to cause localized subsidence. Minor regional subsidence, likely due to ground water withdrawal in the Mojave River area, has been documented as far east as Troy Lake, immediately west of the proposed site. However, negative impacts to the project due to subsidence from tectonism or from petroleum, natural gas, or future ground water production are considered very unlikely.

Expansive Soils

Soil expansion occurs when clay-rich soils with an affinity for water exist in place at a moisture content below their plastic limit. The addition of moisture from irrigation, precipitation, capillary tension, water line breaks, etc. causes the clay soils to absorb water molecules into their structure, which in turn causes an increase in the overall volume of the soil. This increase in volume can correspond to excessive movement (heave) of overlying structural improvements. The alluvium and volcanic rocks which form most of the site subsurface are not considered to be expansive.

Landslides

The proposed site slopes gently to the southwest at a gradient of approximately 2.5%. Due to the low site gradient and the absence of topographically high ground in the vicinity the potential for landslide impacts to the site is considered to be negligible.

Flooding

The proposed Calico Solar Project area has not been mapped by the Federal Emergency Management Agency (FEMA) for flood potential (FEMA 2009). Because the proposed site is topographically elevated above terrain to the south and west, it is staff's opinion that the potential for flooding at the site is limited to infrequent high volume (flash flood) events that may occur due to heavy rainfall in the adjacent Cady Mountains. Flash flooding, if it occurs, will primarily affect the established, entrenched drainages that cross the site from approximately northeast to southwest, and it is considered unlikely that significant overbank flow would occur. Therefore the potential for catastrophic flooding at the proposed Calico Solar Project site is considered to be low. Civil engineering design can minimize the potential for flash floods damage to this project to a (CEQA) less than significant level. Additional discussion of flash flooding is presented under the **Soil and Water** section of this document.

Tsunamis and Seiches

The proposed Calico Solar Project and associated linear facilities are not located near any significant surface water bodies and therefore there is no potential for impacts due to tsunamis and seiches.

Volcanic Hazards

The proposed Calico Solar Project site is located immediately northwest of the Sleeping Beauty volcanic area, an approximately 36 square mile area of Miocene age dacitic to basaltic flows, pyroclastic rocks, and volcaniclastic sediments (Glazner 1980). The Sleeping Beauty area is considered to be part of the regional Amboy Crater – Lavic Lake volcanic hazard area, an approximately 6,000 square mile area within the Mojave Desert designated by the USGS because of the presence of Holocene lava flows, cinder cone formation, and tephra eruptions (Miller 1989). The Amboy Crater – Lavic Lake volcanic hazard area is considered to be subject to future formation of cinder cones, volcanic ash falls, lava flows, and phreatic explosions. The USGS indicates the proposed Calico Solar Project lies in an area which has been and will again be subjected to ash and cinder falls associated with nearby dormant basaltic or basaltic – andesitic vents. The recurrence interval for eruptions from vents in the Amboy Crater – Lavic Lake hazard area has not been predicted but is likely to be in the range of 1,000's of years or more. Therefore staff considers the likelihood of volcanic activity to significantly affect operation of the proposed Calico Solar Project to be low. Eruptive activity would likely be limited to ashfall which would have a minor, short-lived affect on the project. This would involve having to shut down and probably cover the generators to prevent damage from the abrasive ash and having to clean the mirrors once the eruption was over. Mirrors will need to be cleaned periodically as part of normal plant operation and maintenance.

Geological, Mineralogical, and Paleontological Resources

Energy Commission staff has reviewed applicable geologic maps, reports, and on-line resources for this area (Blake 2000; CDMG 1977; CDMG 1981; CDMG 1984; CDMG 1988; CDMG 1990; CDMG 1994; CDMG 1998; CDMG 1999; CDMG 2003; CGS 2002a and b; CGS 2007; Jennings and Saucedo 2002; SCEC 2009; USGS 2003; USGS 2008 and b). Staff did not identify any geological or mineralogical resources at the proposed energy facility location.

The proposed Calico Solar Project is not located within an established Mineral Resource Zone (MRZ) and no economically viable mineral deposits are known to be present (Kohler 2006). Several operating and closed mines and mineral prospects are present within 5 miles of the proposed project boundaries. These have produced a number of industrial minerals, primarily manganese, borates, clay, and talc. No active mines are known to have existed within the proposed project boundaries (USGS 2008b).

Energy Commission staff reviewed the paleontological resources assessment in Section 5.8 and Appendix H of the AFC (SES 2008a) and the confidential paleontological resources report (URS 2008). Staff has also reviewed paleontological literature and records searches conducted by the Natural History Museum of Los Angeles County (McLeod 2009). These studies indicate the Quaternary alluvium, fanglomerate, and volcanic rocks within and near the proposed project site contain few fossils. Older Quaternary alluvium, which underlies the site at uncertain depth, may contain significant fossil vertebrates. Low paleontological sensitivity roughly corresponds to PFYC Class 1 or 2 (Condition 3). Deeper excavations could potentially encounter a high sensitivity formation of PFYC Class 4 (Condition 2).

This assessment is based on SVP criteria, the paleontological report appended to the AFC (PRC 2008), and the independent paleontological assessment of McLeod (2009). Proposed Conditions of Certification **PAL-1** to **PAL-7** are designed to mitigate paleontological resource impacts, as discussed above, to less than significant levels under both NEPA and CEQA. These conditions essentially require a worker education program in conjunction with the monitoring of earthwork activities by a qualified professional paleontologist (a paleontological resource specialist, or PRS).

The proposed conditions of certification allow the BLM Authorized Office, the Energy Commission’s compliance project manager (CPM), and the applicant to adopt a compliance monitoring scheme ensuring compliance with LORS applicable to geologic hazards and the protection of geologic, mineralogic, and paleontological resources.

Construction Impacts and Mitigation

The design-level geotechnical investigation, required for the project by the CBC (2007) and proposed Condition of Certification **GEN-1** should provide standard engineering design recommendations for mitigation of earthquake ground shaking and excessive settlement (see **PROPOSED CONDITIONS OF CERTIFICATION, FACILITY DESIGN**).

As noted above, no viable geological or mineralogical resources are known to exist in the vicinity of the Calico Solar Project construction site. Construction of the proposed project will include grading, foundation excavation, and utility trenching. Based on the soils profile, SVP assessment criteria, and the depth of the potentially fossiliferous older alluvium beneath the site, staff considers the probability of encountering paleontological resources to be low.

Proposed Conditions of Certification **PAL-1** to **PAL-7** are designed to mitigate any paleontological resource impacts, as discussed above, to a less than significant level under NEPA and CEQA. Essentially, Conditions of Certification **PAL-1** to **PAL-7** require a worker education program in conjunction with monitoring of earthwork activities by qualified professional paleontologists (paleontological resource specialist, or PRS). Earthwork is halted any time potential fossils are recognized by either the paleontologist or the worker. For finds deemed significant by the PRS, earthwork cannot restart until all fossils in that strata, including those below the design depth of the excavation, are collected. When properly implemented, the conditions of certification yield a net gain to the science of paleontology since fossils that would not otherwise have been discovered can be collected, identified, studied, and properly curated. A paleontological resource specialist is retained, for the project by the applicant, to produce a monitoring and mitigation plan, conduct the worker training, and provide the monitoring. During the monitoring, the PRS can and often does petition the Energy Commission for a change in the monitoring protocol. Most commonly, this is a request for lesser monitoring after sufficient monitoring has been performed to ascertain that there is little chance of finding significant fossils. In other cases, the PRS can propose increased monitoring due to unexpected fossil discoveries or in response to repeated out-of-compliance incidents by the earthwork contractor.

Based upon the literature and archives search, field surveys, and compliance documentation for the Calico Solar Project, the applicant has proposed monitoring and mitigation measures to be followed during the construction of the project. Energy Commission staff believes that the facility can be designed and constructed to minimize the effect of geologic hazards and impacts to potential paleontological resources at the site during project design life.

Operation Impacts and Mitigation

Operation of the proposed new solar energy generating facility should not have any adverse impact on geologic, mineralogic, or paleontological resources.

Facility Closure

The future decommissioning and closure of the proposed project should not negatively affect geologic, mineralogic, or paleontological resources since the ground disturbed during plant decommissioning and closure would have been already disturbed, and mitigated as required, during construction and operation of the project.

C.4.4.3 CEQA LEVEL OF SIGNIFICANCE

CEQA guidelines state that the environmental analysis "…shall describe feasible measures which could minimize significant adverse impacts, including where relevant, inefficient and unnecessary consumption of energy" (Title 14 CCR §15126.4[a][1]). Appendix F of the guidelines further suggests consideration of such factors as the project's energy requirements and energy use efficiency; its effects on local and regional energy supplies and energy resources; its requirements for additional energy supply capacity; its compliance with existing energy standards; and any alternatives that could reduce the wasteful, inefficient, and unnecessary consumption of energy (Title 14, CCR §15000 et seq., Appendix F).

Energy use, production, and efficiency are addressed in other sections of this document. Energy/efficiency factors affect geological hazards and geologic, mineralogic, and/or paleontological resources only when energy/efficiency concerns require changes to the size or location of the construction zone, as addressed below. Potential impacts to paleontological resources within the proposed project can be mitigated to a (CEQA) less than significant level by adopting and enforcing the proposed Conditions of Certification **PAL-1** through **PAL-7**.

C.4.5 REDUCED ACREAGE ALTERNATIVE

The Reduced Acreage alternative would essentially be a 275-MW solar facility located within the boundaries of the proposed 850-MW project. This alternative and alternative locations of the transmission line, substation, laydown, and control facilities are shown in **Alternatives Figure 1**.

C.4.5.1 SETTING AND EXISTING CONDITIONS

The Reduced Acreage alternative would be a 275-MW solar facility within the Phase 2 boundaries of the proposed project (originally designed by Calico Solar to produce 350 MW). The environmental setting described in **Sections C.4.4.1** and **C.15.4.1** applies to this alternative.

The discussion of impacts to the proposed project, discussed in **Section C.4.4.2**, applies also to the Reduced Acreage alternative. As for the proposed project, two types of impacts are considered. The first is geological hazards, which could impact the proper functioning of the proposed facility and create life/safety concerns. The second is the potential impacts the proposed facility could have on existing geologic, mineralogic, and paleontological resources in the area.

Because the geological setting is the same as that of the proposed project, and the same types of facilities would be constructed in this alternative, the impacts would be the same as for the proposed project. The active geological setting means that the site could be subject to intense levels of earthquake-related ground shaking. The effects of strong ground shaking would need to be mitigated through structural designs required by the California Building Code (CBC 2007) and the project geotechnical report. The CBC (2007) requires that structures be designed to resist seismic stresses from ground acceleration and, to a lesser extent, liquefaction potential. A geotechnical investigation has been performed and presents standard engineering design recommendations for mitigation of seismic shaking and site soil conditions.

There are no known viable geological or mineralogical resources at the proposed Calico Solar Project site, so none exist on the Reduced Acreage alternative. Because the Reduced Acreage alternative is also located in geological formations with low to possibly high paleontological sensitivity (PFYC Class 1 or 2 [Condition 3]; PFYC Class 4

[Condition 2]), there is the potential for impacts to paleontological resources to occur; these would be mitigated through worker training and monitoring by qualified paleontologists, as required by Conditions of Certification, **PAL-1** through **PAL-7**. Since the Reduced Acreage plant would occupy only 2,300 acres (28% of the proposed project's 8,230 acres), its potential to encounter and positively or negatively impact significant fossils would be reduced to about 28% of that of the proposed project.

C.4.5.2 ASSESSMENT OF IMPACTS AND DISCUSSION OF MITIGATION

Since the Reduced Acreage plant would produce only 275 MW (32% of the proposed project's 850 MW), its impacts on the Southern California Edison grid would be proportionately less.

C.4.5.3 CEQA LEVEL OF SIGNIFICANCE

Like the proposed project, the potential is low for significant adverse impacts to the Reduced Acreage alternative from geological hazards during its design life and moderate to high paleontological resources from the construction, operation, and closure of the proposed project. It is staff's conclusion that the alternative will be designed and constructed in accordance with all applicable laws, ordinances, regulations, and standards and in a manner that both protects environmental quality and assures public safety. The CEQA level of significance would remain unchanged from the proposed project.

C.4.6 AVOIDANCE OF DONATED AND ACQUIRED LANDS ALTERNATIVE

The Avoidance of Donated and Acquired Lands Alternative would be an approximately 720-MW solar facility located within the boundaries of the proposed 850-MW project. This alternative, the transmission line, substation, laydown, and control facilities are shown in **Alternatives Figure 2**.

C.4.6.1 SETTING AND EXISTING CONDITIONS

The general setting and existing conditions would remain as described in **Sections C.4.4.1** and **C.15.4.1** although the land requirements would be proportionately reduced to reflect the smaller project size. Locations of laydown areas may also vary.

C.4.6.2 ASSESSMENT OF IMPACTS AND DISCUSSION OF MITIGATION

The discussion of impacts to the proposed project, discussed in **Sections C.4.4.2**, applies also to the Avoidance alternative. As for the proposed project, two types of impacts are considered. The first is geological hazards, which could impact the proper functioning of the proposed facility and create life/safety concerns. The second is the potential impacts the proposed facility could have on existing geologic, mineralogic, and paleontological resources in the area.

Because the geological setting is the same as that of the proposed project, and the same types of facilities would be constructed in this alternative, the impacts would be the same as for the proposed project. The active geological setting means that the site could be subject to intense levels of earthquake-related ground shaking. The effects of strong ground shaking would need to be mitigated through structural designs required by the California Building Code (CBC 2007) and the project geotechnical report. The CBC (2007) requires that structures be designed to resist seismic stresses from ground acceleration and, to a lesser extent, liquefaction potential. A geotechnical investigation has been performed and presents standard engineering design recommendations for mitigation of seismic shaking and site soil conditions.

There are no known viable geological or mineralogical resources at the proposed Calico Solar Project site, so none exist on the Avoidance alternative. Because the Avoidance alternative is also located in geological formations with moderate to possibly high paleontological sensitivity (PFYC Class 1 [Condition 3] or; Class 4 [Condition 2]), there is the potential for impacts to paleontological resources to occur; these would be mitigated through worker training and monitoring by qualified paleontologists, as required by Conditions of Certification, **PAL-1** through **PAL-7**. Since the Avoidance alternate plant would occupy only about 7,000 acres (28% of the proposed project's 8,230 acres), its potential to encounter and positively or negatively impact significant fossils would be reduced to about 28% of that of the proposed project. Since the Reduced Acreage plant would occupy only 2,300 acres (85% of the proposed project's 8,230 acres), its potential to encounter and positively or negatively impact significant fossils would be reduced to about 85% of that of the proposed project.

C.4.6.3 CEQA LEVEL OF SIGNIFICANCE

Like the proposed project, the potential is low for significant adverse impacts to the Avoidance alternative from geological hazards during its design life and moderate to high for paleontological resources from the construction, operation, and closure of the proposed project. It is staff's conclusion that the alternative will be designed and constructed in accordance with all applicable laws, ordinances, regulations, and standards and in a manner that both protects environmental quality and assures public safety. The CEQA level of significance would remain unchanged from the proposed project.

C.4.7 NO PROJECT / NO ACTION ALTERNATIVE

There are three No Project / No Action Alternatives evaluated as follows:

NO PROJECT / NO ACTION ALTERNATIVE #1

No Action on the Calico Solar Project application and on CDCA land use plan amendment

Under this alternative, the proposed Calico Solar Project would not be approved by the CEC and BLM and BLM would not amend the CDCA Plan. As a result, no solar energy project would be constructed on the project site and BLM would continue to manage the site consistent with the existing land use designation in the CDCA Land Use Plan of 1980, as amended.

The results of the No Project / No Action Alternative would be the following:

- Any potential impacts of the proposed project to geologic, mineralogic, or paleontological resources would not occur. However, the land on which the project is proposed would become available to other uses that are consistent with BLM's land use plan, including another renewable energy project.
- The benefits of the proposed project in displacing fossil fuel fired generation and reducing associated greenhouse gas emissions from gas-fired generation would not occur. Both State and Federal law support the increased use of renewable power generation.

If the proposed project is not approved, renewable projects would likely be developed on other sites in San Bernardino County, the Mojave Desert, or in adjacent states as developers strive to provide renewable power that complies with utility requirements and State/Federal mandates. For example, there are dozens of other wind and solar projects that have applications pending with BLM in the California Desert District.

NO PROJECT / NO ACTION ALTERNATIVE #2

No Action on the Calico Solar Project and amend the CDCA land use plan to make the area available for future solar development

Under this alternative, the proposed Calico Solar Project would not be approved by the CEC and BLM and BLM would amend the CDCA Land Use Plan of 1980, as amended, to allow for other solar projects on the site. As a result, it is possible that another solar energy project could be constructed on the project site.

Because the CDCA Plan would be amended, it is possible that the site would be developed with the same or a different solar technology. Different solar technologies require different amounts of construction and operations maintenance; however, it is expected that all the technologies would require the same geological hazard mitigation and would require the same safeguards to protect potential paleontological resources as the proposed project. The CEQA level of significance would remain unchanged from the proposed project.

NO PROJECT / NO ACTION ALTERNATIVE #3

No Action on the Calico Solar Project application and amend the CDCA land use plan to make the area unavailable for future solar development

Under this alternative, the proposed Calico Solar Project would not be approved by the CEC and BLM and the BLM would amend the CDCA Plan to make the proposed site unavailable for future solar development. As a result, no solar energy project would be constructed on the project site and BLM would continue to manage the site consistent with the existing land use designation in the CDCA Land Use Plan of 1980, as amended.

Because the CDCA Plan would be amended to make the area unavailable for future solar development, it is expected that the site would continue to remain in its existing condition, with no new structures or facilities constructed or operated on the site. As a result, there would be no potential impacts on geologic, mineralogic, or paleontological resources. However, in the absence of this project, other renewable energy projects may be constructed to meet State and Federal mandates, and those projects would have similar paleontological impacts in other locations.

C.4.8 PROJECT-RELATED FUTURE ACTIONS - GEOLOGY, PALEONTOLOGY AND MINERALS

This section examines the potential impacts of future transmission line construction, line removal, substation expansion, and other upgrades that may be required by Southern California Edison Company (SCE) as a result of the Calico Solar Project. The SCE upgrades are a reasonably foreseeable event if the Calico Solar Project is approved and constructed as proposed.

The SCE project will be fully evaluated in a future Environmental Impact Report (EIR)/EIS prepared by the BLM and the California Public Utilities Commission. Because no application has yet been submitted and the SCE project is still in the planning stages, the level of impact analysis presented is based on available information. The purpose of this analysis is to inform the Energy Commission and BLM, interested parties, and the general public of the potential environmental and public health effects that may result from other actions related to the Calico Solar Project.

The project components and construction activities associated with these future actions are described in detail in Section B.3 of this Staff Assessment/EIS. This analysis examines the construction and operational impacts of two upgrade scenarios

- The 275-MW Early Interconnection Option would include upgrades to the existing SCE system that would result in 275 MW of additional latent system capacity. Under the 275-MW Early Interconnection option, Pisgah Substation would be expanded adjacent to the existing substation, one to two new 220-kV structures would be constructed to support the gen-tie from the Calico Solar Project into Pisgah Substation, and new telecommunication facilities would be installed within existing SCE ROWs.
- The 850-MW Full Build-Out Option would include replacement of a 67-mile-long 220-kV SCE transmission line with a new 500-kV line, expansion of the Pisgah Substation at a new location and other telecommunication upgrades to allow for additional transmission system capacity to support the operation of the full Calico Solar Project.

C.4.8.1 ENVIRONMENTAL SETTING

The environmental setting described herein incorporates both the 275-MW Early Interconnection and the 850-MW Full Build-Out options. The setting for the 275-MW Early Interconnection upgrades at the Pisgah Substation and along the telecomm corridors is included within the larger setting for the project area under the 850-MW Full Build-Out option.

The SCE upgrades would be within the southern portion of the Mojave Desert Geomorphic Province of California. The Mojave Desert is bounded on the north and northwest by the Tehachapi Mountains, on the west by the Garlock fault, on the east by the Colorado River, and on the south and southwest by the San Andreas Fault. The Mojave Desert Province is characterized by broad alluvial basins of Cenozoic sedimentary and volcanic materials overlying older plutonic and metamorphic rocks (SES 2008a). The plutonic and metamorphic rocks are exposed as eroded hills throughout the region. The alluvial basins are up to several thousand feet thick.

Structurally the transmission corridor traverses a series of large alluvial fans adjacent to metamorphosed sediments that have been intruded by masses of quartz monzonite. The surficial alluvial deposits are classified as Younger Alluvium and consist of interbedded sand and gravel with lesser amounts of silt and clay. The sand and gravel deposits are generally unconsolidated to weakly consolidated sediments. The alluvium was derived from erosion of the San Gabriel and San Bernardino Mountains to the south. The Mojave River channel and associated tributaries have dissected the alluvium and continue to deposit younger alluvium in active channels. The Younger Alluvium could be underlain at the subsurface by Older Alluvium.

Geology

The project area can be subdivided into three generalized geologic areas; the western, central, and northern areas. The western portion of the Lugo-Pisgah transmission line alignment in and around Hesperia can be characterized as high desert plains and foothills of the western Mojave Desert. This area is mostly alluvial plain and pediment, with relatively small areas of hills and low mountains. This subsection contains mainly Mesozoic granitic rocks and Quaternary alluvium and lacustrine deposits. Eolian sand deposits are common. There are small areas of Precambrian gneiss and schist and Miocene and Pliocene nonmarine sedimentary rocks.

This portion of the alignment is on mostly very gently to moderately sloping pediments and alluvial fans and nearly level basin floor and dry lake bed. There are a few moderately steep hills and steep slopes traversed (i.e., Fry Mountains). Pediments are quite extensive. The elevation range is mostly from about 2,000 to 3,000 feet. Fluvial erosion and deposition and eolian deflation and deposition are the main geomorphic processes.

The central portion of the Lugo-Pisgah alignment includes mountains, hills, pediments, and alluvial plain. The area of pediment and alluvial plain is greater than that of mountains and hills. The bedrock through the central portion of the alignment is mainly Mesozoic granitic rocks that are exposed at the surface in only a few areas in the vicinity of the Rodman Mountains and Lava beds Mountains. There is Precambrian metamorphic rock associated with slopes and hills crossed and some Mesozoic mafic plutonic and Paleozoic marine sedimentary rock immediately south of the corridor. Transported Quaternary deposits, mostly alluvium that include lacustrine deposits and eolian sand are the predominant geologic mapping unit in this central portion of the alignment and along the entire alignment.

There are some steep mountains and moderately steep hills in the central and in the northern portion of the corridor. The elevation range is from about 1,600 feet up to 4,000 feet in the Granite Mountains and Rodman Mountains. Mass wasting, fluvial erosion and deposition, and eolian deflation and deposition are the main geomorphic processes.

The northern portion of the transmission corridor and in the area of the Pisgah Substation is characterized by half upland terrain, including pediments, and half alluvial plain. There are many small mountain ranges and hills with many different orientation patterns. The Mesozoic plutonic rocks are mostly granitic, but include some mafic rocks. There are also areas of Quaternary volcanic, Tertiary nonmarine sedimentary, Pre-Cretaceous metamorphic, Paleozoic marine sedimentary and Precambrian metamorphic rocks.

The majority of the transmission alignment consists of generally flat terrain which is not prone to significant mass wasting or slope stability problems. Where the Lugo-Pisgah transmission ROW does traverse a hillside or slope, the parent material is predominantly granitic or volcanic thereby minimizing the risk of landslides.

Seismicity

The SCE upgrades would be located in a seismically active region that has experienced numerous earthquakes in the past. The Alquist-Priolo Special Studies Zones Act specifies that an area termed an “Earthquake Fault Zone” is to be delineated if surrounding faults that are deemed “sufficiently active” or “well defined” after a review of seismic records and geological studies. Cities and counties affected by the Earthquake Fault Zones must regulate certain existing and development projects within the zones by permitting and building code enforcement.

Fourteen (14) major faults would be crossed by the Lugo-Pisgah 500-kV transmission ROW. Most of these faults trend northwest to southeast. Movement along the faults is predominantly strike slip and/or dip slip. The major faults crossed by the 850-MW Full Build-Out transmission line and substation upgrades include the following crossings and ages (SES 2008a):

- Calico-Hidalgo fault zone, Calico section (age: <1,600,000 years)
- Helendale-South Lockhart fault zone, Helendale section (age: <15,000 years)
- Lenwood-Lockhart fault zone, Lenwood section (age: <130,000 years)
- North Frontal thrust system, Western section (age: <130,000 years)
- Johnson Valley fault zone, Northern Johnson Valley section (age: <15,000 years)
- Pisgah-Bullion fault zone, Pisgah section (age: <15,000 years)
- Lavic Lake fault (age: <15,000 years)
- Camp Rock-Emerson-Copper Mountain fault zone, Emerson section (age: <150 years)
- Lavic Lake fault (age: <150 years)
- Calico-Hidalgo fault zone, West Calico section (age: <15,000 years)
- Helendale-South Lockhart fault zone, Helendale section (age: <15,000 years)

- Camp Rock-Emerson-Copper Mountain fault zone, Camp Rock section (age: <150 years)
- Lenwood-Lockhart fault zone, Lenwood section (age: <15,000 years)
- North Frontal thrust system, Western section (age: <15,000 years)

Paleontology

The upgrades area is located in the western portion of the Mojave Desert geomorphic region. The Mojave Desert is bounded on the north and northwest by the Tehachapi Mountains, on the west by the Garlock fault, on the east by the Colorado River, and on the south and southwest by the San Andreas Fault. The Mojave Desert Province is characterized by broad alluvial basins of Cenozoic sedimentary and volcanic materials overlying older plutonic and metamorphic rocks (SES 2008a).

The project area traverses the Mojave Desert region, beginning at the Pisgah Volcano area and terminating on the outskirts of Hesperia, California. A variety of paleontological resources have the potential to be present within the project area. Known areas of paleontology resources present within the general vicinity of the project area have been identified by the San Bernardino County Museum (SBCM). The Victorville and Hesperia regions have Pliocene and Pleistocene age fossils present (SES 2008a). Deposits from these epochs have been identified as Irvingtonian and Blancan mammal. In the vicinity of Barstow, California, the Barstow Formation is known to contain a diversity of fossil resources, including Barstow Fauna and Tick Canyon Fauna.

Minerals

There are 92 mines within San Bernardino County. Major minerals extracted in the Mojave River project area include gold, silver, feldspar, uranium, copper, iron, tungsten, turquoise, zeolite, barite, and clay. Limestone, sand, and gravel for cement and aggregate used for road construction are found at several locations throughout the area.

C.4.8.2 ENVIRONMENTAL IMPACTS

Geology

Soils and rock testing should be conducted and analyzed by a professional, licensed geotechnical engineer or geologist to determine existing foundation conditions. Exploration in sufficient quantity to adequately gather variations in the foundation conditions should be conducted to collect samples for testing. The type of materials, shear strength, resistivity, and shrink-swell potential are among the items that should be considered. The results of the geotechnical investigation would then be applied to the project's engineering design and this would ensure that potential impacts associated with problematic soils and slope instability are reduced to less than significant levels. Excavation and grading for structure foundations, work areas, access roads, and spur roads could loosen soil and accelerate erosion.

Construction-related impacts to the geologic environment primarily are related to terrain modification (cuts, fills, temporary access roads, and drainage diversion measures) and dust generation. Other than the Pisgah Crater, no major unique geologic or physical features have been identified along the proposed corridor for the 850-MW Full Build-Out. Construction would not require cut and fill activities at most foundation sites and grading would not require import or export of earthen materials to/from the site. Some grading could be necessary for access roads; although, these can often be minimized by use of helicopters to deliver and set the transmission line components. Thus, significant impacts are not expected from geologic hazards or geological/mineralogical resources during construction. No evidence of ground subsidence caused by groundwater extraction has been noted at the existing substation sites or along the transmission corridor.

Regional and local geologic conditions would not be altered significantly by the long-term operation of the proposed upgrades. With the exception of the Pisgah Crater, no other major unique geologic or physical features would be directly affected by the transmission corridor. This potential impact however would be considered minor as the proposed transmission corridor would parallel other existing transmission lines across this feature. The transmission corridor and substation sites may be underlain by deposits of sand and gravel, and these resources could not be recovered and used during the active life of the project.

The project area is subject to ground shaking from nearby and distant earthquakes. Project structures would be designed to meet the seismic design standards of the CBC in effect at the time of design (currently 2007 edition). At least 14 faults have been identified along the proposed transmission corridor. More detailed investigations would identify whether ground rupture potential exists along the corridor; although, typically the lines are designed to span the fault zones. Due to the depth to groundwater, liquefaction is not expected to occur. To ensure that collapse potential is minimized all foundations, structures, or substation facilities would be designed in accordance with subsequent geotechnical investigations.

In summary, identified potential geologic hazards associated with the proposed upgrade options would be ground shaking from earthquakes, possible ground rupture at fault crossings, and the potential for localized low-strength foundation sites.

Paleontology

Construction of the 500-kV transmission line and substation expansion could destroy or disturb significant paleontological resources located within the project area with construction-related ground disturbances, such as the building or improvement of access and spur roads, staging area clearing, borehole drilling, trenching, excavating, grading, and vegetation removal. The decommissioning and removal of the existing transmission may also require ground clearing activities for access road improvements and construction of staging areas for dismantling the tower structures. There may also be an increase in public travel within the project area if new access roads open a previously inaccessible area. Increased public access may increase fossil removal activities within the project area. Indirect impacts to paleontological resources may include erosion of features due to channeling of runoff or modification of drainage channels. Construction activities in the vicinity of fossil resources may also cause erosion or damage to outcrop areas, due to earth shaking activities associated with drilling activities.

Minerals

Although no known mining operations have been identified in the project area, construction of the SCE upgrades could potentially interfere with daily ongoing or planned mining operations in the event that the project is constructed on or near a an active mine or a significant mineral resource.

C.4.8.3 MITIGATION

Site-specific geotechnical and seismic conditions would be appropriately addressed in the detailed engineering design and construction of towers and facilities. The following mitigation measures are included in Appendix EE of the Calico Solar Project AFC and recommended in this Staff Assessment/EIS to reduce impacts:

- Transmission structures and substation facilities should be designed in accordance with current CBC seismic and the design requirements and methodology of the Electrical Power Research Institute (EPRI).
- Transmission structures and substation facilities should be designed in accordance with recommendations provided in preliminary geotechnical reports and as amended by future geotechnical investigations with respect to collapsible.

In addition, implementation of mitigation measures discussed under **Soils and Water** section in this Staff Assessment/EIS would reduce the amount of erosion that would result from construction. In addition, compliance with a Storm Water Pollution Prevention Plan (SWPPP) would limit erosion from the construction site. With implementation of measures and best management practices that would ensure proper re-vegetation, erosion control, drainage, seismic design, among other requirements, SCE's project upgrades would create a less than significant impact to geology and paleontology.

Impacts to paleontological resources that may exist would be potentially significant. Recommended mitigation should provide for a paleontological resources inventory after final project design, pre-construction planning for monitoring and treatment of paleontological resources, and for monitoring during construction. The mitigation should require a qualified paleontological monitor and qualified paleontologist to monitor for significant subsurface fossils and then collect, analyze and curate any significant fossils found. In addition, the following mitigation measures are recommended for paleontological resources by SES in Appendix EE of the AFC:

- Prior to initiation of project construction activities the project area ROW and proposed and existing access roads should be surveyed by a Qualified Paleontologist.
- Based on the results of the paleontology resource survey, a paleontology resource management plan should be prepared and submitted to the Energy Commission and BLM for review and approval.
- All project construction staff should be trained in the importance of paleontological resources and the routine identification of fossil resources.

Implementation of this suggested paleontological mitigation would reduce project impacts to paleontological resources to a less than significant level.

If the project may potentially impact any planned or active mineral extraction operations, then SCE should coordinate with operations and management personnel, and with BLM, to determine status of and plans for active mining operations adjacent to or crossed by project alignments. SCE should develop a plan to avoid or minimize interference with mining operations in conjunction with mine/quarry operators prior to construction.

C.4.8.4 CONCLUSION

Southern California Edison would comply with applicable LORS as related to the identified upgrades project. No significant geological, paleontological or mineral resources have been identified in the project area; however, technical investigations/surveys have not yet been performed. The upgraded lines and substation equipment would be designed and constructed in accordance seismic requirements of SCE's Construction Standards and CPUC General Order 95 and EPRI. The project would have minimal potential to impact geological, paleontological or mineral resources if it implements the recommended mitigation and complies with applicable LORS.

C.4.9 CUMULATIVE IMPACT ANALYSIS

Section B.3, Cumulative Scenario, provides detailed information on the potential cumulative solar and other development projects in the project area. Together, these projects comprise the cumulative scenario which forms the basis of the cumulative impact analysis for the proposed project. In summary, these projects are:

- Renewable energy projects on BLM, State, and private lands, as shown on Cumulative Impacts Figures 1 and 2 and in Cumulative Tables 1A and 1B. Although not all of those projects are expected to complete the environmental review processes, or be funded and constructed, the list is indicative of the large number of renewable projects currently proposed in California.
- Foreseeable future projects in the immediate Newberg Springs/Ludlow area, as shown on Cumulative Impacts Figure 3, Newberg Springs/Ludlow Area Existing and Future/Foreseeable Projects, and Cumulative Tables 2 and 3. Table 2 presents existing projects in this area and Table 3 presents future foreseeable projects in the area. Both tables indicate project name and project type, its location and its status.

These projects are defined within a geographic area that has been identified by the CEC and BLM as covering an area large enough to provide a reasonable basis for evaluating cumulative impacts for all resource elements or environmental parameters. Most of these projects have, are, or will be required to undergo their own independent environmental review under CEQA and/or NEPA. Even if the cumulative projects described in Section B.3 have not yet completed the required environmental processes, they were considered in the cumulative impacts analyses in this SA/Draft EIS.

C.4.9.1 GEOGRAPHIC SCOPE OF ANALYSIS

The geographic area considered for cumulative impacts on geology and paleontology is the central portion of the Mojave Desert geomorphic province of south-central California (Norris and Webb 1990). More specifically, the area includes most of San Bernardino and Riverside Counties. The potential impacts are limited to those involving paleontological resources since no geological or mineralogical resources have been identified within the boundaries of the proposed project. There are no geological hazards with potential cumulative effects, other than regional subsidence from ground water withdrawal. Significant ground water withdrawal is not part of the proposed project.

C.4.9.2 EFFECTS OF PAST AND PRESENT PROJECTS

Any previously completed project involving subsurface excavation with paleontological monitoring could already have had a detrimental effect on paleontological resources in the area defined above under **Geographic Scope of Analysis**. Given the general scarcity of fossils, even within known fossil bearing strata, the likelihood of prior damage is modest but unavoidable, after the fact.

The existing projects most likely to have damaged paleontological resources in geological formation similar to those of the proposed Calico Solar Project site include, by virtue of size and location:

- Twenty-Nine Palms Marine Corps Air-Guard Combat Center
- SEGS I and II Solar Generating Facilities

C.4.9.3 EFFECTS OF REASONABLY FORESEEABLE FUTURE PROJECTS

As shown in **Section B.3, Cumulative Scenario Table 1A**, the Barstow office of the BLM is aware of 18 solar energy and 25 wind energy potential projects totaling 304,120 acres of land under their jurisdiction. All energy projects on BLM land would be subject to paleontological monitoring and mitigation during construction. When properly implemented and enforced, these safeguards would provide adequate protection of paleontological resources, reducing potential impacts to a (CEQA) less than significant level.

In addition to potential renewable energy projects on BLM land, a large number of renewable energy, residential, and public works projects are proposed for the Mojave and Colorado Desert regions of Southern California on State and private lands. These projects are summarized in **Table 1B** of **Section B.3, Cumulative Scenario**. Of these, the following projects have the greatest potential to affect paleontological resources within the geographic scope of this analysis:

- Abengoa Mojave Solar Power Project
- Alta-Oak Creek Mojave (Wind) Project
- Rice Solar Energy Project

These projects would be subject to CEC and/or CEQA environmental review which would include requirements for construction monitoring and mitigation of potential paleontological resources. When properly implemented and enforced, these safeguards should provide adequate protection of paleontological resources, reducing potential impacts to a (CEQA) less than significant level.

Contribution of the Calico Solar Project to Cumulative Impacts

Construction of the proposed Calico Solar Project would require localized excavation or ground disturbance over a very large area. Because the project area lies within geologic units with moderate to high paleontological sensitivity, the required excavation could, potentially, damage paleontological resources. Any damage could be cumulative to damage from other projects within the same geological formations. Implementation and enforcement of a properly designed Paleontological Resource Monitoring and Mitigation Plan (PRMMP) at this Calico Solar Project site should result in a net gain to the science of paleontology by allowing fossils that would not otherwise have been found to be recovered, identified, studied, and preserved. Cumulative impacts from Calico Solar Project, in consideration with other nearby similar projects, should therefore be either neutral (no fossils encountered) or positive (fossils encountered, preserved, and identified).

Operation. The operation of the Calico Solar Project would not present additional risk to geological resources (none identified) or paleontological resources. Once ground disturbing activity is complete plant operation has no real potential to further affect paleontological resources. Therefore, routine plant operation would not increase potential cumulative effects on paleontological resources. The longer the plant operates, however, the more likely it is to be damaged by hazards, primarily earthquake-related ground shaking. Construction and operation of the plant does not increase the potential of geological hazards at the site, just their potential to damage civil improvements.

Decommissioning. The decommissioning of the Calico Solar Project is expected to result in no adverse impacts related to geology or paleontology. Any potential impact to geological resources (none identified) or paleontological resources would have occurred and been completed during the ground disturbing phase of project construction.

C.4.10 COMPLIANCE WITH LORS

Federal, state, or local/county laws, ordinances, regulations, and standards (LORS) applicable to this project or alternatives other than the No Project / No Action alternative, were detailed in **Geology and Paleontology Table 1**. Staff anticipates that the project will be able to comply with applicable LORS.

C.4.11 NOTEWORTHY PUBLIC BENEFITS

The science of paleontology is advanced by the discovery, study and curation of new fossils. These fossils can be significant if they represent a new species, verify a known species in a new location and/or if they include structures of similar specimens that had not previously been found preserved. In general, most fossil discoveries are the result of excavations, either purposeful in known or suspected fossil localities or as the result of excavations made during earthwork for civil improvements or mineral extraction. Proper monitoring of excavations at the proposed Calico Solar Power facility, in accordance with an approved Paleontological Resources Monitoring and Mitigation Plan, could result in a benefit to the science of paleontology and should minimize the potential to damage a significant paleontological resource.

C.4.12 PROPOSED CONDITIONS OF CERTIFICATION/MITIGATION MEASURES

General conditions of certification with respect to engineering geology are proposed under Conditions of Certification **GEN-1, GEN-5, and CIVIL-1** in the **FACILITY DESIGN** section. Proposed paleontological conditions of certification follow. It is staff's opinion that the likelihood of encountering paleontological resources is low at the plant site.

PAL-1 The project owner shall provide the compliance project manager (CPM) with the resume and qualifications of its paleontological resource specialist (PRS) for review and approval. If the approved PRS is replaced prior to completion of project mitigation and submittal of the Paleontological Resources Report, the project owner shall obtain CPM approval of the replacement PRS. The project owner shall keep resumes on file for qualified paleontological resource monitors (PRMs). If a PRM is replaced, the resume of the replacement PRM shall also be provided to the CPM.

The PRS resume shall include the names and phone numbers of references. The resume shall also demonstrate to the satisfaction of the CPM the appropriate education and experience to accomplish the required paleontological resource tasks.

As determined by the CPM, the PRS shall meet the minimum qualifications for a vertebrate paleontologist as described in the Society of Vertebrate Paleontology (SVP) guidelines of 1995. The experience of the PRS shall include the following:

1. Institutional affiliations, appropriate credentials, and college degree;
2. Ability to recognize and collect fossils in the field;
3. Local geological and biostratigraphic expertise;
4. Proficiency in identifying vertebrate and invertebrate fossils; and
5. At least 3 years of paleontological resource mitigation and field experience in California and at least one year of experience leading paleontological resource mitigation and field activities.

The project owner shall ensure that the PRS obtains qualified paleontological resource monitors to monitor as he or she deems necessary on the project. Paleontological resource monitors (PRMs) shall have the equivalent of the following qualifications:

- BS or BA degree in geology or paleontology and one year of experience monitoring in California; or
- AS or AA in geology, paleontology, or biology and 4 years' experience monitoring in California; or
- Enrollment in upper division classes pursuing a degree in the fields of geology or paleontology and 2 years of monitoring experience in California.

Verification: (1) At least 60 days prior to the start of ground disturbance, the project owner shall submit a resume and statement of availability of its designated PRS for on-site work.

(2) At least 20 days prior to ground disturbance, the PRS or project owner shall provide a letter with resumes naming anticipated monitors for the project, stating that the identified monitors meet the minimum qualifications for paleontological resource monitoring required by the condition. If additional monitors are obtained during the project, the PRS shall provide additional letters and resumes to the CPM. The letter shall be provided to the CPM no later than one week prior to the monitor's beginning on-site duties.

(3) Prior to the termination or release of a PRS, the project owner shall submit the resume of the proposed new PRS to the CPM for review and approval.

PAL-2 The project owner shall provide to the PRS and the CPM, for approval, maps and drawings showing the footprint of the power plant, construction lay-down areas, and all related facilities. Maps shall identify all areas of the project where ground disturbance is anticipated. If the PRS requests enlargements or strip maps for linear facility routes, the project owner shall provide copies to the PRS and CPM. The site grading plan and plan and profile drawings for the utility lines would be acceptable for this purpose. The plan drawings should show the location, depth, and extent of all ground disturbances and be at a scale between 1 inch = 40 feet and 1 inch = 100 feet. If the footprint of the project or its linear facilities changes, the project owner shall provide maps and drawings reflecting those changes to the PRS and CPM.

If construction of the project proceeds in phases, maps and drawings may be submitted prior to the start of each phase. A letter identifying the proposed schedule of each project phase shall be provided to the PRS and CPM. Before work commences on affected phases, the project owner shall notify the PRS and CPM of any construction phase scheduling changes.

At a minimum, the project owner shall ensure that the PRS or PRM consults weekly with the project superintendent or construction field manager to confirm area(s) to be worked the following week and until ground disturbance is completed.

Verification: (1) At least 30 days prior to the start of ground disturbance, the project owner shall provide the maps and drawings to the PRS and CPM.

(2) If there are changes to the footprint of the project, revised maps and drawings shall be provided to the PRS and CPM at least 15 days prior to the start of ground disturbance.

(3) If there are changes to the scheduling of the construction phases, the project owner shall submit a letter to the CPM within 5 days of identifying the changes.

PAL-3 The project owner shall ensure that the PRS prepares, and the project owner submits to the CPM for review and approval, a paleontological resources monitoring and mitigation plan (PRMMP) to identify general and specific measures to minimize potential impacts to significant paleontological resources. Approval of the PRMMP by the CPM shall occur prior to any ground disturbance. The PRMMP shall function as the formal guide for monitoring, collecting, and sampling activities and may be modified with CPM approval. This document shall be used as the basis of discussion when on-site decisions or changes are proposed. Copies of the PRMMP shall reside with the PRS, each monitor, the project owner's on-site manager, and the CPM.

The PRMMP shall be developed in accordance with the guidelines of the Society of Vertebrate Paleontology (SVP 1995) and shall include, but not be limited, to the following:

1. Assurance that the performance and sequence of project-related tasks, such as any literature searches, pre-construction surveys, worker environmental training, fieldwork, flagging or staking, construction monitoring, mapping and data recovery, fossil preparation and collection, identification and inventory, preparation of final reports, and transmittal of materials for curation will be performed according to PRMMP procedures;
2. Identification of the person(s) expected to assist with each of the tasks identified within the PRMMP and the conditions of certification;
3. A thorough discussion of the anticipated geologic units expected to be encountered, the location and depth of the units relative to the project when known, and the known sensitivity of those units based on the occurrence of fossils either in that unit or in correlative units;
4. An explanation of why, how, and how much sampling is expected to take place and in what units. Include descriptions of different sampling procedures that shall be used for fine-grained and coarse-grained units;
5. A discussion of the locations of where the monitoring of project construction activities is deemed necessary, and a proposed plan for monitoring and sampling;
6. A discussion of procedures to be followed in the event of a significant fossil discovery, halting construction, resuming construction, and how notifications will be performed;
7. A discussion of equipment and supplies necessary for collection of fossil materials and any specialized equipment needed to prepare, remove, load, transport, and analyze large-sized fossils or extensive fossil deposits;
8. Procedures for inventory, preparation, and delivery for curation into a retrievable storage collection in a public repository or museum, which meet the Society of Vertebrate Paleontology's standards and requirements for the curation of paleontological resources;
9. Identification of the institution that has agreed to receive data and fossil materials collected, requirements or specifications for materials delivered

for curation and how they will be met, and the name and phone number of the contact person at the institution; and

10. A copy of the paleontological conditions of certification.

<u>Verification:</u> At least 30 days prior to ground disturbance, the project owner shall provide a copy of the PRMMP to the CPM. The PRMMP shall include an affidavit of authorship by the PRS and acceptance of the PRMMP by the project owner evidenced by a signature.

PAL-4 Prior to ground disturbance and for the duration of construction activities involving ground disturbance, the project owner and the PRS shall prepare and conduct weekly CPM-approved training for the following workers: project managers, construction supervisors, foremen, and general workers involved with or who operate ground-disturbing equipment or tools. Workers shall not excavate in sensitive units prior to receiving CPM-approved worker training. Worker training shall consist of an initial in-person PRS training during the project kick off for those mentioned above. Following initial training, a CPM-approved video or in-person training may be used for new employees. The training program may be combined with other training programs prepared for cultural and biological resources, hazardous materials, or other areas of interest or concern. No ground disturbance shall occur prior to CPM approval of the Worker Environmental Awareness Program (WEAP), unless specifically approved by the CPM.

The WEAP shall address the possibility of encountering paleontological resources in the field, the sensitivity and importance of these resources, and legal obligations to preserve and protect those resources.

The training shall include:

1. A discussion of applicable laws and penalties under the law;
2. Good quality photographs or physical examples of vertebrate fossils for project sites containing units of high paleontological sensitivity;
3. Information that the PRS or PRM has the authority to halt or redirect construction in the event of a discovery or unanticipated impact to a paleontological resource;
4. Instruction that employees are to halt or redirect work in the vicinity of a find and to contact their supervisor and the PRS or PRM;
5. An informational brochure that identifies reporting procedures in the event of a discovery;
6. A WEAP certification of completion form signed by each worker indicating that he/she has received the training; and
7. A sticker that shall be placed on hard hats indicating that environmental training has been completed.

Verification: (1) At least 30 days prior to ground disturbance, the project owner shall submit the proposed WEAP, including the brochure, with the set of reporting procedures for workers to follow.

(2) At least 30 days prior to ground disturbance, the project owner shall submit the script and final video to the CPM for approval if the project owner is planning to use a video for interim training.

(3) If the owner requests an alternate paleontological trainer, the resume and qualifications of the trainer shall be submitted to the CPM for review and approval prior to installation of an alternate trainer. Alternate trainers shall not conduct training prior to CPM authorization.

(4) In the monthly compliance report (MCR), the project owner shall provide copies of the WEAP certification of completion forms with the names of those trained and the trainer or type of training (in-person or video) offered that month. The MCR shall also include a running total of all persons who have completed the training to date.

PAL-5 The project owner shall ensure that the PRS and PRM(s) monitor consistent with the PRMMP all construction-related grading, excavation, trenching, and augering in areas where potential fossil-bearing materials have been identified, both at the site and along any constructed linear facilities associated with the project. In the event that the PRS determines full-time monitoring is not necessary in locations that were identified as potentially fossil bearing in the PRMMP, the project owner shall notify and seek the concurrence of the CPM.

The project owner shall ensure that the PRS and PRM(s) have the authority to halt or redirect construction if paleontological resources are encountered. The project owner shall ensure that there is no interference with monitoring activities unless directed by the PRS. Monitoring activities shall be conducted as follows:

1. Any change of monitoring from the accepted schedule in the PRMMP shall be proposed in a letter or email from the PRS and the project owner to the CPM prior to the change in monitoring and will be included in the monthly compliance report. The letter or email shall include the justification for the change in monitoring and be submitted to the CPM for review and approval.

2. The project owner shall ensure that the PRM(s) keep a daily monitoring log of paleontological resource activities. The PRS may informally discuss paleontological resource monitoring and mitigation activities with the CPM at any time.

3. The project owner shall ensure that the PRS notifies the CPM within 24 hours of the occurrence of any incidents of non-compliance with any paleontological resources conditions of certification. The PRS shall recommend corrective action to resolve the issues or achieve compliance with the conditions of certification.

4. For any significant paleontological resources encountered, either the project owner or the PRS shall notify the CPM within 24 hours, or Monday morning in the case of a weekend event, where construction has been halted because of a paleontological find.

The project owner shall ensure that the PRS prepares a summary of monitoring and other paleontological activities placed in the monthly compliance reports. The summary will include the name(s) of PRS or PRM(s) active during the month; general descriptions of training and monitored construction activities; and general locations of excavations, grading, and other activities. A section of the report shall include the geologic units or subunits encountered, descriptions of samplings within each unit, and a list of identified fossils. A final section of the report will address any issues or concerns about the project relating to paleontological monitoring, including any incidents of non-compliance or any changes to the monitoring plan that have been approved by the CPM. If no monitoring took place during the month, the report shall include an explanation in the summary as to why monitoring was not conducted.

Verification: The project owner shall ensure that the PRS submits the summary of monitoring and paleontological activities in the MCR. When feasible, the CPM shall be notified 10 days in advance of any proposed changes in monitoring different from the plan identified in the PRMMP. If there is any unforeseen change in monitoring, the notice shall be given as soon as possible prior to implementation of the change.

PAL-6 The project owner, through the designated PRS, shall ensure that all components of the PRMMP are adequately performed including collection of fossil materials, preparation of fossil materials for analysis, analysis of fossils, identification and inventory of fossils, the preparation of fossils for curation, and the delivery for curation of all significant paleontological resource materials encountered and collected during project construction.

Verification: The project owner shall maintain in his/her compliance file copies of signed contracts or agreements with the designated PRS and other qualified research specialists. The project owner shall maintain these files for a period of 3 years after project completion and approval of the CPM-approved paleontological resource report (see Condition of Certification **PAL-7**). The project owner shall be responsible for paying any curation fees charged by the museum for fossils collected and curated as a result of paleontological mitigation. A copy of the letter of transmittal submitting the fossils to the curating institution shall be provided to the CPM.

PAL-7 The project owner shall ensure preparation of a Paleontological Resources Report (PRR) by the designated PRS. The PRR shall be prepared following completion of the ground-disturbing activities. The PRR shall include an analysis of the collected fossil materials and related information and submit it to the CPM for review and approval.

The report shall include, but is not limited to, a description and inventory of recovered fossil materials; a map showing the location of paleontological resources encountered; determinations of sensitivity and significance; and a statement by the PRS that project impacts to paleontological resources have been mitigated below the level of significance.

Verification: Within 90 days after completion of ground-disturbing activities, including landscaping, the project owner shall submit the PRR under confidential cover to the CPM.

C.4.13 CONCLUSIONS

The proposed Calico Solar Project site is located in an active geologic area of the north-central Mojave Desert Geomorphic Province in central San Bernardino County in south-central California. Because of its geologic setting, the site could be subject to intense levels of earthquake-related ground shaking. The effects of strong ground shaking would need to be mitigated, to the extent practical, through structural designs required by the California Building Code (CBC 2007) and the project geotechnical report. The CBC (2007) requires that structures be designed to resist seismic stresses from ground acceleration and, to a lesser extent, liquefaction. A geotechnical investigation has been performed and presents standard engineering design recommendations for mitigation of seismic shaking and site soil conditions.

There are no known viable geologic or mineralogical resources at the proposed Calico Solar Project site. Locally, paleontological resources have been documented within older Quaternary alluvium which underlies the younger Quaternary alluvium of the site surface. Potential impacts to paleontological resources would be mitigated through worker training and monitoring by qualified paleontologists, as required by Conditions of Certification, **PAL-1** through **PAL-7**.

Based on its independent research and review, California Energy Commission and U.S. Bureau of Land Management staff believes that the potential is low for significant adverse impacts to the proposed project from geologic hazards during its design life and to potential geologic, mineralogic, and paleontological resources from the construction, operation, and closure of the proposed project. It is staff's opinion that the Calico Solar Project could be designed and constructed in accordance with all applicable laws, ordinances, regulations, and standards and in a manner that both protects environmental quality and assures public safety, to the extent practical.

Certification of Completion
Worker Environmental Awareness Program
Calico Solar Project (08-AFC-13)

This is to certify these individuals have completed a mandatory California Energy Commission-approved Worker Environmental Awareness Program (WEAP). The WEAP includes pertinent information on cultural, paleontological, and biological resources for all personnel (that is, construction supervisors, crews, and plant operators) working on site or at related facilities. By signing below, the participant indicates that he/she understands and shall abide by the guidelines set forth in the program materials. Include this completed form in the Monthly Compliance Report.

No.	Employee Name	Title/Company	Signature
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Cultural Trainer: ______________ Signature:___________________ Date: ___/___/____

PaleoTrainer: _______________ Signature:___________________ Date: ___/___/____

Biological Trainer: ______________Signature:________________ Date:___/___/__

C.4.14 REFERENCES

Blake, T.F. 2006, EQFAULT™ Version 3.00, A Computer Program for the Deterministic Estimation of Peak Acceleration Using Three-Dimensional California Faults as Earthquake Sources, http://thomasfblake.con/eqfault.htm.

Byers, William G., 2000, Railroad Damage from the October 16, 1999 Hector Mine Earthquake, Burlington Northern and Santa Fe Railway Internal Report.

CBC—California Building Code, 2007.

CDMG 1977—California Division of Mines and Geology, Geology and Mineral Resources of Imperial County, California, DMG County Report 7.

CDMG 1981, Preliminary Map of October 1979 Fault Ruptures, Imperial County, California, DMG Open File Report 81-5.

CDMG 1984, Preliminary Geologic Map of the California-Baja California Border Region, DMG Open File Report 84-59.

CDMG 1988, Preliminary Map of the Quaternary Faults in Southeastern San Diego County and in Southwestern Imperial County California, DMG Open File Report 88-6.

CDMG 1990, Industrial Minerals in California: Economic Importance, Present Availability, and Future Development, Special Publication 105, reprinted from U.S. Geological Survey Bulletin 1958.

CDMG 1994, Fault Activity Map of California and Adjacent Areas with Locations and Ages of Recent Volcanic Eruptions, Scale: 1:750,000.

CDMG 1998, Gold Districts of California, Sesquicentennial Edition, California Gold Discovery to Statehood, Bulletin 193.

CDMG 1999, Mines and Mineral Producers Active in California (1997–1998), Special Publication 103.

CDMG 2003, Fault Investigation Reports for Development Sites Within Alquist-Priolo Earthquake Fault Zones in Southern California, 1974–2000.

CGS 2002a—California Geological Survey, Fault Evaluation Reports Prepared Under the Alquist-Priolo Earthquake Fault Zoning Act, Region 2 – Southern California, CD 2002-02.

CGS 2002b, Probablistic Seismic Hazard Assessment Online Database, http://www.conservation.ca.gov/cgs/rghm/psha/

CGS 2007, California Historical Earthquake Online Database, http://www.consrv.ca.gov/cgs/rghm/quakes/historical/.

Dibblee, Thomas W. Jr, 2008, Geologic Map of the Newberry and Cady Mountains 15 Minute Quadrangles, Dibblee Geology Center Map DF-394. Santa Barbara Museum of Natural History.

Dokka, R.K., and Travis, C.J., 1990, Late Cenozoic Strike-Slip Faulting in the Mojave Desert, California, Tectonics, v.9, p.311-340.

FEMA 2009—Federal Emergency Management Agency, Telephone communication, July 22, 2009.

Glazner, Allen F., Geology of the Sleeping Beauty Area, Southeastern Cady Mountains, Geology and Mineral Wealth of the California Desert, South Coast Geological Survey, October, 1980.

Glazner, Allen F., Bartley, John M., and Sanner, Wayne K., 2000, Nature of the Southwestern Boundary of the Central Mojave Tertiary Province, Rodman Mountains, California, Geological Society of America Bulletin v. 112, no. 1, January, 2000.

Jennings, Charles W. and George J. Saucedo, 2002, Simplified Fault Activity Map of California, CGS Map Sheet 54.

Kohler, Susan, 2006, Aggregate Availability in California, California Geological Survey Map Sheet 52.

McLeod, Samuel A., 2009, Paleontological Resources for the Proposed SES Calico Solar Project Power Plant, Natural History Museum of Los Angeles County private correspondence.

Miller, Dan C., 1989, Potential Hazards from Future Volcanic Eruptions in California, USGS Bulletin 1847.

Norris, R. M. and R. W. Webb, 1990, Geology of California, Second Edition, John Wiley and Sons, New York.

PRC 2008—PaleoResource Consultants, Paleontological Resources Technical Report for the Calico Solar Project.

Ross, Timothy M., 1995, North-South-Directed Extension, Timing of Extension, and Vertical-Axis Rotation of the Southwest Cady Mountains, Mojave Desert, California, Geological Society of America Bulletin v.107. No.7. July 1995.

SCEC 2009—Southern California Earthquake Center, Data Center website: http://www.data.scec.org/.

SES 2008a—SES Solar One, LLC, Application for Certification for the Stirling Energy Systems (SES) Calico Solar Project, Volumes 1 and 2, Submitted to the California Energy Commission, June 30, 2008.

SVP 1995—Society of Vertebrate Paleontology, Measures for Assessment and Mitigation of Adverse Impacts to Non-Renewable Paleontological Resources: Standard Procedures.

Treiman, J.A., Kendrick, K.J., Bryant, W.A., Rockwell, T.K., and McGill, S.F., 2002, Primary Surface Rupture Associated with the M_w 7.1 16 October 1999 Hector Mine Earthquake, San Bernardino County, California, Bulletin of the Seismological Society of America, Volume 92, Number 4, May 2002.

URS 2008—URS Corporation Inc., Preliminary Geotechnical and Geologic Hazards Evaluation Calico Solar Project San Bernardino County, California.

USDI 2007—United States Department of the Interior, Bureau of Land Management, Potential Fossil Yield Classification (PFYC) System for Paleontological Resources on Public Land, Instruction Memorandum No. 2008-009, dated October 15, 2007.

USGS 2003—U.S. Geological Survey, Earthquake Hazards Program Search Results for Class A and B Faults, USGS website http://gldims.cr.usgs.gov/webapps/cfusion/Sites/qfault/index.cfm

USGS 2008a, Earthquake Hazards Program, Seismic Design for Buildings, USGS website http://earthquake.usgs.gov/research/hazmap/design/.

USGS 2008b, Mineral Resources On-Line Spatial Data, USGS website http://mrdata.usgs.gov/.

Yashinsky, M., Simek, J., Murugesh, G., and Mualchin, L., 2002, Highway Performance during the 16 October 1999 Hector Mine, California, Earthquake, Bulletin of the Seismological Society of America, Volume 92, Number 4, May 2002.

C.5 – HAZARDOUS MATERIALS MANAGEMENT

Testimony of Rick Tyler and Alvin Greenberg, Ph.D.

C.5.1 SUMMARY OF CONCLUSIONS

The Bureau of Land Management and California Energy Commission staff's (referred to as staff hereafter) evaluation of the proposed project, along with staff's proposed mitigation measures, indicate that hazardous materials use at the proposed Calico Solar Project (formerly the Stirling Energy Systems Solar One Project) would not present a significant impact (pursuant to the California Environmental Quality Act) and NEPA on the public. With adoption of the proposed conditions of certification, the proposed project would comply with all applicable laws, ordinances, regulations, and standards.

C.5.2 INTRODUCTION

The purpose of this **HAZARDOUS MATERIALS MANAGEMENT** section of this Staff Assessment/Draft Environmental Impact Statement (SA/DEIS) is to determine if the proposed Calico Solar Project could potentially cause significant impacts [pursuant to the California Environmental Quality Act (CEQA) and NEPA] to the public from the use, handling, storage, or transportation of hazardous materials at the proposed project site. If significant adverse impacts to the public are identified, Energy Commission staff must evaluate facility design alternatives and additional mitigation measures to reduce those impacts to the extent feasible.

This analysis does not address the potential exposure of workers to hazardous materials used at the proposed project site. Employers must inform employees of hazards associated with their work and provide those employees with special protective equipment and training to reduce the potential for health impacts from the handling of hazardous materials. The **WORKER SAFETY AND FIRE PROTECTION** section of this document describes the protection of workers from those risks.

For this analysis, staff examines plausible potential loss of containment incidents (spills) for the hazardous materials to be used at the proposed facility. The worst case plausible event, regardless of cause, is considered, and analyzed to see whether the potential impacts and risk to local populations are significant (pursuant to CEQA). Hazardous material handling and usage procedures are designed to reduce the likelihood of a spill, to reduce its potential size, and to prevent or reduce the potential migration of a spill off site to the extent that there would not be significant off-site impacts to the public. These measures seek to minimize direct contact from runoff of spills, air-borne plume concentrations, and the potential for spills to mix with runoff water and be carried offsite. Generally, staff seeks to confirm that the applicant has proposed secondary containment basins for containing liquids, and that volatile chemicals would have a restricted release to the atmosphere after capture. Containment basins are designed to be able to hold the contents of a full tank plus the potential rainfall from a 25-year storm without any loss of containment. The spilled material, along with any mixed-in water and any contaminated soils, would then be placed into containers and processed and disposed of as required by regulations.

Hazardous materials such as mineral and lubricating oils, corrosion inhibitors, herbicides, and acids and bases to control pH would be present at the proposed project site. Hazardous materials used during the construction phase include gasoline, diesel fuel, motor oil, lubricants, and small amounts of solvents and paint. No chemicals regulated as extremely hazardous materials would be used on-site during construction. None of the materials proposed for use pose a significant potential for off-site impacts as a result of the quantities on-site, their relative toxicity, their physical states, and/or their environmental mobility.

The Calico Solar Project would also require the transportation of certain liquid and solid hazardous materials to the facility. This document addresses all potential impacts associated with the use, storage, and transport of hazardous materials.

C.5.3 METHODOLOGY AND THRESHOLDS FOR DETERMINING ENVIRONMENTAL CONSEQUENCES

LAWS, ORDINANCES, REGULATION, AND STANDARDS

The following federal, state, and local laws and policies apply to the protection of public health and hazardous materials management. Staff's analysis examines the project's compliance with these requirements.

Hazardous Materials Management Table 1
Laws, Ordinances, Regulations, and Standards (LORS)

Applicable Law	Description
Federal	
The Superfund Amendments and Reauthorization Act of 1986 (42 USC §9601 et seq.)	Contains the Emergency Planning and Community Right To Know Act (also known as SARA Title III).
The Clean Air Act (CAA) of 1990 (42 USC 7401 et seq. as amended)	Establishes a nationwide emergency planning and response program, and imposes reporting requirements for businesses that store, handle, or produce significant quantities of extremely hazardous materials.
The CAA Section on Risk Management Plans (42 USC §112(r)	Requires states to implement a comprehensive system to inform local agencies and the public when a significant quantity of such materials is stored or handled at a facility. The requirements of both SARA Title III and the CAA are reflected in the California Health and Safety Code, section 25531, et seq.
49 CFR 172.800	Requires that the suppliers of hazardous materials prepare and implement security plans in accordance with U.S. Department of Transportation (DOT) regulations.

Applicable Law	Description
49 CFR Part 1572, Subparts A and B	Requires that suppliers of hazardous materials ensure that their hazardous material drivers comply with personnel background security checks.
The Clean Water Act (CWA) (40 CFR 112)	Aims to prevent the discharge or threat of discharge of oil into navigable waters or adjoining shorelines. Requires a written spill prevention, control, and countermeasures (SPCC) plan to be prepared for facilities that store oil that could leak into navigable waters.
Title 49, Code of Federal Regulations, Part 190	Outlines gas pipeline safety program procedures.
Title 49, Code of Federal Regulations, Part 191	Addresses the transportation of natural and other gases by pipeline. Requires preparation of annual reports, incident reports, and safety-related condition reports. Also requires operators of pipeline systems to notify the U.S. Department of Transportation DOT) of any reportable incident by telephone and submit a follow-up written report within 30 days.
Title 49, Code of Federal Regulations, Part 192	Addresses transportation of natural and other gases by pipeline: Requires minimum federal safety standards, specifies minimum safety requirements for pipelines, and includes material selection, design requirements, and corrosion protection. The safety requirements for pipeline construction vary according to the population density and land use that characterize the surrounding land. This part also contains regulations governing pipeline construction, which must be followed for Class 2 and Class 3 pipelines, and requirements for preparing a pipeline integrity management program.
6 CFR Part 27	The CFATS (Chemical Facility Anti-Terrorism Standard) regulation of the U.S. Department of Homeland Security (DHS) that requires facilities that use or store certain hazardous materials to submit information to the DHS so that a vulnerability assessment can be conducted to determine what certain specified security measures shall be implemented.
State	
California Health and Safety Code, section 25531 to 25543.4	The California Accidental Release Program (Cal-ARP) requires the preparation of a Risk Management Plan (RMP) and Off-site Consequence Analysis (OCA) and submittal to the local Certified Unified Program Agency (CUPA) for approval.

Applicable Law	Description
Title 8, California Code of Regulations, Section 5189	Requires facility owners to develop and implement effective safety management plans to ensure that large quantities of hazardous materials are handled safely. While these requirements primarily provide for the protection of workers, they also indirectly improve public safety and are coordinated with the RMP process.
Title 8, California Code of Regulations, Section 5189	Sets forth requirements for design, construction, and operation of the vessels and equipment used to store and transfer ammonia. These sections generally codify the requirements of several industry codes including the American Society for Material Engineering (ASME) Pressure Vessel Code, the American National Standards Institute (ANSI) K61.1, and the National Boiler and Pressure Vessel Inspection Code. These codes apply to anhydrous ammonia but are also used to design storage facilities for aqueous ammonia.
California Health and Safety Code, Section 41700	Requires that "No person shall discharge from any source whatsoever such quantities of air contaminants or other material which causes injury, detriment, nuisance, or annoyance to any considerable number of persons or to the public, or which endanger the comfort, repose, health, or safety of any such persons or the public, or which cause, or have a natural tendency to cause injury or damage to business or property."
California HSC Sections 25270 through 25270.13	Requires the preparation of a Spill Prevention, Control, and Countermeasures (SPCC) Plan if 10,000 gallons or more of petroleum is stored on-site. The above regulations would also require the immediate reporting of a spill or release of 42 gallons or more to the California Office of Emergency Services and the Certified Unified Program Agency (CUPA).
California Safe Drinking Water and Toxic Enforcement Act (Proposition 65)	Prevents certain chemicals that cause cancer and reproductive toxicity from being discharged into sources of drinking water.
Local	
2007 California Fire Code Title 24, Part 9	Adopts the California Fire Code, 2007 Edition, into San Bernardino County regulations.

The San Bernardino County Fire Department (SBCFD) is the Certified Unified Program Agency (CUPA) in the project area, and is responsible for reviewing Hazardous Materials Business Plans and Risk Management Plans. With regard to seismic safety issues, the proposed Calico Solar Project site is located in Seismic Risk Zone 4. The construction and design of buildings and vessels storing hazardous materials would meet the seismic requirements of the Uniform Building Code (SES 2008a).

C.5.4 PROPOSED PROJECT

The proposed Calico Solar Project site is approximately 8,230 acres of Bureau of Land Management (BLM)-managed land located in San Bernardino County, California (SES 2008a page 3-3). The site is located on Hector Road north of Interstate 40, 17 miles east of Newberry Springs and 115 miles east of Los Angeles, California in the Mojave Desert (SES 2008a page 1-1). The project consists of 29 contiguous parcels (SES 2008a Appendix T). The Burlington Northern Santa Fe (BNSF) railroad bisects the site from west to east (SES 2008a 3-22).

The proposed project would utilize SunCatchers – 40-foot tall Stirling dish technology developed by the applicant – that track the sun and focus solar energy onto Power Conversion Units (PCU) (SES 2008a 3-2). The dish assembly collects and focuses solar energy onto the PCU to generate electricity. Each PCU consists of a solar receiver heat exchanger and a closed-cycle, high-efficiency Solar Stirling Engine specifically designed to convert solar power to rotary power via a thermal conversion process. The engine drives an electrical generator to produce grid-quality electricity.

C.5.4.1 SETTING

Several characteristics of an area in which a project is located affect its potential for an accidental release of a hazardous material to result in a significant public exposure. These include:

- local meteorology;
- terrain characteristics; and
- location of population centers and sensitive receptors relative to the project.

Meteorological Conditions

Meteorological conditions, including wind speed, wind direction, and air temperature, affect both the extent to which accidentally released hazardous materials would be dispersed into the air and the direction in which they would be transported. This affects the potential magnitude and extent of public exposure to such materials, as well as their health risks. When wind speeds are low and the atmosphere is stable, dispersion is severely reduced and can lead to increased localized public exposure.

Recorded wind speeds, ambient air temperatures, and terrain characteristics are described in the Air Quality section (C.5.2) and Appendix V of the Application for Certification (AFC) (SES 2008a).

Terrain Characteristics

The location of elevated terrain is often an important factor in assessing potential exposure. An emission plume from an accidental release may impact high elevations before it impacts lower elevations. The topography of the Calico Solar Project site (like it’s immediately surrounding areas) is essentially flat.

Location of Exposed Populations and Sensitive Receptors

The general population includes many sensitive subgroups that may be at greater risk from exposure to emitted pollutants. These sensitive subgroups include the very young, the elderly, and those with existing illnesses. In addition, the location of the population in the area surrounding a project site may have a large bearing on health risk. There are no sensitive receptors within the project vicinity. The nearest residence to the Calico Solar Project is more than a mile from the hydrogen storage facility at the project (SES 2008a, Section 5.16).

C.5.4.2 ASSESSMENT OF IMPACTS AND DISCUSSION OF MITIGATION

Method and Threshold for Determining CEQA Significance

Staff reviews and assesses the potential for the transportation, handling, and use of hazardous materials to impact the surrounding community. All chemicals and natural gas were evaluated. Staff's analysis examines the potential impacts on all off-site members of the population including the young, the elderly, and people with existing medical conditions that may make them more sensitive to the adverse effects of hazardous materials. In order to accomplish this goal, staff utilizes the most current acceptable public health exposure levels (both acute and chronic) to protect the public from the effects of an accidental chemical release.

In order to assess the potential of released hazardous materials migrating off-site and impacting the public, staff analyzes several aspects of the proposed use of materials at a facility. Staff recognizes that some hazardous materials must be used at solar power plants. Therefore, staff conducts its analysis by focusing on the choice and amount of chemicals to be used, the manner in which the applicant would use the chemicals, the manner by which it would be transported to the facility and transferred to facility storage tanks, and the way in which the applicant plans to store those materials on-site.

Staff reviews the applicant's proposed engineering and administrative controls for hazardous material use. Engineering controls are physical or mechanical systems such as storage tanks or automatic shut-off valves that can prevent a spill of hazardous material from occurring, or that can limit the spill to a small amount or confine it to a small area. Administrative controls are rules and procedures that workers must follow to help either prevent accidents or keep them small if they do occur. Both engineering and administrative controls can act as either methods of prevention or methods of response and minimization. In both cases, the goal is to prevent a spill from moving off-site and harming the public.

Staff reviews and evaluates the proposed use of hazardous materials, as described by the applicant. Staff's assessment follows the five steps listed below:

- Step 1: Staff reviews the chemicals and amounts proposed for on-site use, as listed in and determined the need and appropriateness of their use. Only those that are needed and appropriate are allowed to be used. If staff feels that a safer alternative chemical can be used, staff would recommend or require its use, depending upon the impacts posed.

- Step 2: Chemicals proposed for use in small amounts or whose physical state is such that there is virtually no chance that a spill would migrate off the site and impact the public are removed from further assessment.
- Step 3: Measures proposed by the applicant to prevent spills are reviewed and evaluated. These included engineering controls such as automatic shut-off valves and different size transfer-hose couplings and administrative controls such as worker training and safety management programs.
- Step 4: Measures proposed by the applicant to respond to accidents are reviewed and evaluated. These measures also included engineering controls such as catchment basins and methods to keep vapors from spreading, and administrative controls such as training emergency response crews.
- Step 5: Staff then analyzes the theoretical impacts on the public of a worst-case spill of hazardous materials even with the mitigation measures proposed by the applicant. When mitigation methods proposed by the applicant are sufficient, no further mitigation is recommended. If the proposed mitigation is not sufficient to reduce the potential for adverse impacts to an insignificant level, staff would propose additional prevention and response controls until the potential for causing harm to the public is reduced to an insignificant level. It is only at this point that staff can recommend that the project be allowed to use hazardous materials.

Direct/Indirect Impacts and Mitigation

Small Quantity Hazardous Materials

In conducting this analysis, staff reviewed Tables 5.15-1 and 2 of the AFC (SES 2008a, section 5.15) and determined in Steps 1 and 2 that most of the proposed materials, although present at the proposed facility, pose a minimal potential for off-site impacts since they would be stored in small quantities, have low mobility, low vapor pressure, and/or low levels of toxicity. These hazardous materials, which were eliminated from further consideration, are discussed briefly below.

During the construction phase of the project, the only hazardous materials proposed for use include paint, cleaners, solvents, gasoline, diesel fuel, motor oil, welding gases, and lubricants. Any impact of spills or other releases of these materials would be limited to the site because of the small quantities involved, the infrequent use and hence reduced chances of release, and/or the temporary containment berms used by contractors. Petroleum hydrocarbon-based motor fuels, mineral oil, lube oil, and diesel fuel all have very low volatility and would represent limited off-site hazards, even in larger quantities.

During operations, hazardous chemicals such as cleaning agents, lube oil, sodium hypochlorite, diesel fuel, gasoline, ethylene glycol, and other various chemicals (see **Hazardous Materials Appendix A** for a list of all chemicals proposed to be used and stored at the Calico Solar Project site) would be used and stored on-site and represent limited off-site hazard due to their small quantities, low volatility, and/or low toxicity.

After removing from consideration those chemicals that pose no potential for risk of off-site impact in Steps 1 and 2, staff continued with Steps 3, 4, and 5 to review the remaining hazardous material, hydrogen gas.

Large Quantity Hazardous Materials

Hydrogen

Hydrogen is used as the working fluid in the Stirling cycle engines utilized by the project. The proposed project involves 34,000 individual engines and solar collectors. Originally, the applicant proposed use of hydrogen storage at each collector engine assembly. The proposal was later modified to utilize onsite hydrogen generation. This eliminated the use of 34,000 individual small hydrogen storage bottles at each assembly. It also eliminated the constant transportation of hydrogen bottles to and from the site. Staff views this change in the project as risk reduction particularly to road users. The project now involves the use of a distributed hydrogen system described in Supplement to the Application for Certification and the resultant amount of hydrogen that will be used on-site will be 7,162,148 cubic feet, approximately 37,243 lbs (SES 2009d).

The applicant conducted an analysis assuming a worst case release of all the hydrogen on site. It was assumed that a hydrogen release would form a vapor cloud and detonate causing an unconfined vapor cloud explosion. The distance to an over pressure of 1.0 psi was then determined. This is an overpressure that could cause some damage to structures and injury to exposed members of the general population. The maximum distance to this level of impact was estimated to be .054 miles. There are no public receptors at this distance and in general such overpressures of 1.0 psi would be confined to the project site depending on the location of the cloud at detonation. It should be noted that it is nearly impossible to detonate hydrogen in an unconfined vapor cloud because it disperses very rapidly due to its low density relative to air. It should also be noted that the applicant’s release scenarios are very conservative in assuming an instantaneous release of the entire volume of hydrogen instead of a more realistic release occurring over a period of time resulting in significant dispersion of the hydrogen while the cloud was forming. Actual experience with hydrogen releases have not resulted in unconfined cloud explosions. It is wildly believed that unconfined hydrogen will not detonate without a high explosive initiating event (Lees 1998).

Staff concurs with the analysis and a conclusion provided by SES and independently concludes that the applicant’s analysis is a very conservative and overestimate of both the magnitude the potential risk of any actual explosion that could occur at the facility. It is staff’s conclusion that an unconfined hydrogen vapor cloud explosion is not plausible and will not occur at the proposed facility. Thus, the use of hydrogen at the proposed facility poses a risk of an on-site fire but no plausible potential for a significant impact on surrounding populations or the environment.

Mitigation

Staff believes that this project’s use of hazardous materials poses no significant risk (pursuant to CEQA) but only if mitigation measures are used. These mitigation measures are discussed in this section. The potential for accidents resulting in the release of hazardous materials is greatly reduced by the implementation of a Safety Management Program, which includes both engineering and administrative controls. Elements of facility controls and the safety management plan are summarized below.

Engineering Controls

Engineering controls help prevent accidents and releases (spills) from moving off-site and impacting the community by incorporating engineering safety design criteria into the project's design. Engineering safety features proposed by the applicant include:

- Usage of secondary containment areas surrounding each of the hazardous materials storage areas, designed to contain accidental releases during storage;
- Physical separation of stored chemicals in isolated containment areas, separated by a noncombustible partition in order to prevent the accidental mixing of incompatible materials, which may in turn cause the formation and release of toxic gases or fumes.

Administrative Controls

Administrative controls help prevent accidents and releases (spills) from moving off-site and impacting the community by establishing worker training programs and process safety management programs.

A Worker Health and Safety Program would be prepared by the applicant and include (but not be limited to) the following elements (see the **WORKER SAFETY/FIRE PROTECTION** section in this analysis for specific regulatory requirements):

- Worker training on chemical hazards, health and safety issues, and hazard communication;
- Procedures to ensure the proper use of personal protective equipment;
- Safety operating procedures for the operation and maintenance of systems that use hazardous materials;
- Fire safety and prevention; and
- Emergency response actions including facility evacuation, hazardous material spill cleanup, and fire prevention.

At the Calico Solar Project, the project owner would be required to designate an individual who would have the responsibility and authority to ensure a safe and healthful workplace. This project health and safety official would oversee the health and safety program and would have the authority to halt any action or modify any work practice in order to protect the workers, facility, and the surrounding community in the event that the health and safety program is violated.

Staff proposes Condition of Certification **HAZ-1** which requires that no hazardous material would be used at the facility except as listed in the AFC and reviewed for appropriateness, unless there is prior approval by the Energy Commission Compliance Project Manager (CPM) and the BLM Approved Safety Officer. Staff reviewed the chemicals and amounts proposed for on-site use, as listed in Table 5.15-2 of the AFC and concurred with the need and appropriateness of their use. **HAZ-1** also requires changes to the allowed list of hazardous materials and their maximum amounts to be approved by the CPM. Only those that are needed and appropriate would be allowed to be used. If staff feels that a safer alternative chemical can be used, staff would recommend or require its use, depending upon the impacts posed (see Appendix A for the list of proposed hazardous materials to be used).

A Hazardous Materials Business Plan (HMBP), a Risk Management Plan (RMP), and a Spill Prevention, Control, and Countermeasures Plan (SPCC Plan) would also be prepared by the applicant that would incorporate state requirements for the handling of hazardous materials (SES 2008a, section 5.15). Staff proposes Condition of Certification **HAZ-2** which ensures that the HMBP (which includes the Inventory and Site Map, an Emergency Response Plan, Owner/Operator Identification, and Employee Training), an RMP, and a SPCC Plan would be provided to the San Bernardino County Fire Department so that they can better prepare emergency response personnel for handling emergencies which could occur at the facility.

On-site Spill Response

In order to address spill response, the facility would prepare and implement an emergency response plan that includes information on hazardous materials contingency and emergency response procedures, spill containment and prevention systems, personnel training, spill notification, on-site spill containment, prevention equipment and capabilities, etc. Emergency procedures would be established which include evacuation, spill cleanup, hazard prevention, and emergency response. The presence of oil in a quantity greater than 1,320 gallons might invoke a requirement to prepare a Spill Prevention, Control, and Countermeasure (SPCC) Plan if other requirements are met. The quantity of oil contained in any one of the planned 230/500 kV transformers would be in excess of the minimum quantity that requires such a plan. However, there are no known Waters of the United States but they may be Waters of the State and thus staff's position is that no SPCC Plan is required by 40 CFR 112 but is required pursuant to California HSC Sections 25270 through 25270.13. Therefore, the Calico Solar Project will be required to prepare a SPCC because it will store 10,000 gallons or more of petroleum on-site. The above regulations would also require the immediate reporting of a spill or release of 42 gallons or more to the California Office of Emergency Services and the Certified Unified Program Agency (CUPA).

Personnel working with hazardous materials will be trained in proper handling and emergency response to chemical spills or accidental releases. Designated personnel will also be trained as a project hazardous materials response team which would be the first responder to hazardous materials incidents. In the event of a large incident involving hazardous materials, backup support would be provided by the San Bernardino County Fire Department (SBCFD) which has a hazmat response unit capable of handling any incident at the proposed Calico Solar Project. The SBCFD Hazmat unit is located at Station #322 in Adelanto, about a one-hour drive away (SBCFD 2010).

Staff concludes that, given the remote location, the hazardous material response time is acceptable, and that the SBCFD is adequately trained and equipped to respond to a hazardous materials spill emergency at Calico Solar in a timely manner.

Transportation of Hazardous Materials

Containerized hazardous materials would be transported to the facility via truck. During construction and operation of the Calico Solar Project, staff believes that minimal amounts and types of hazardous materials (paint, cleaners, solvents, gasoline, diesel fuel, motor oil, lubricants, sodium hypochlorite, and welding gases in standard-sized cylinders) do not pose a significant risk (pursuant to CEQA) of either spills or public impacts along any transportation route. Staff therefore does not recommend a specific route.

Liquid hazardous materials can be released during a transportation accident, and the extent of their impact in the event of a release would depend on the location of the accident and the rate of vapor dispersion from the surface of the spilled pool. The likelihood of an accidental release during transport is dependent upon the truck driver, the type of vehicle used for transport; and accident rates for the type of road.

In determining that the risk of accident and release during the transportation of hazardous materials to the site, staff determined that the transport on I-40 and then for a short distance from I-40 on a dedicated road in a remote area would present a less than significant risk of accident and release. In making this determination, staff relied upon the extensive regulatory program that applies to shipment of hazardous materials on California Highways to ensure safe handling in general transportation (see the Federal Hazardous Materials Transportation Law 49 USC §5101 et seq, the U.S. Department of Transportation Regulations 49 CFR Subpart H, §172-700, and the California DMV Regulations on Hazardous Cargo). These regulations also address driver competence. See AFC section 5.11 for additional information on regulations governing the transportation of hazardous materials.

Seismic Issues

The possibility exists that an earthquake could cause the failure of a hazardous materials storage tank. A quake could also cause the failure of the secondary containment system (berms and dikes), as well as electrically controlled valves and pumps. The failure of all these preventive control measures might then result in the release of hazardous materials. The effects of the Loma Prieta earthquake of 1989, the Northridge earthquake of 1994, and the earthquake in Kobe, Japan, in January 1995, heighten concerns about earthquake safety.

Information obtained after the January 1994 Northridge earthquake showed that some damage was caused to several large and small storage tanks at the water treatment system of a cogeneration facility. The tanks with the greatest damage, including seam leakage, were older tanks, while newer tanks sustained lesser damage with displacements and attached line failures. Therefore, staff conducted an analysis of the codes and standards, which should be followed to adequately design and build storage tanks and containment areas that could withstand a large earthquake. Staff also reviewed the impacts of the February 2001 Nisqually earthquake near Olympia, Washington, a state with similar seismic design codes as California. No hazardous materials storage tanks were impacted by this quake. Referring to the sections on **GEOLOGIC RESOURCES AND HAZARDS** and **FACILITY DESIGN** in the AFC, staff notes that the proposed facility would be designed and constructed to the applicable standards of the 2007

California Building Code for Seismic Zone 4 (SES 2008a). Therefore, on the basis of damage experienced from the Northridge quake to older tanks and the lack of failures during the Nisqually earthquake with newer tanks, staff determined that tank failures during seismic events are not likely and do not represent a significant risk (pursuant to CEQA) to the public.

Site Security

The Calico Solar Project proposes to use hazardous materials which necessitates that special site security measures should be developed and implemented to prevent unauthorized access. The North American Electric Reliability Corporation (NERC) published *Security Guidelines for the Electricity Sector* in 2002 (NERC 2002) and the U.S. Department of Energy published a draft *Vulnerability Assessment Methodology for Electric Power Infrastructure* in 2002 (DOE 2002). The energy generation sector is one of 14 areas of critical Infrastructure listed by the U.S. Department of Homeland Security. On April 9, 2007, the U.S Department of Homeland Security published, in the Federal Register (6 CFR Part 27), an Interim Final Rule requiring facilities that use or store certain hazardous materials to conduct vulnerability assessments and implement certain specified security measures. This rule was implemented with the publication of Appendix A, the list of chemicals, on November 2, 2007 and hydrogen is listed as a Chemical of Interest with a threshold level of 10,000 lbs. The Calico project will have a maximum of 37,243 lbs of hydrogen on-site and therefore the CFATS regulation will apply and the project owner will need to submit a “Top Screen” assessment to the DHS. However the DHS decides to regulate the site and even if it decides not to require security measures at the Calico Solar Project, staff believes that all power plants under the jurisdiction of the Energy Commission should implement a minimum level of security consistent with the guidelines listed here.

In order to ensure that this facility (or a shipment of hazardous material) is not the target of unauthorized access, staff’s proposed conditions of certification **HAZ-4** and **HAZ-5** address both construction security and operations security plans. These plans would require the implementation of site security measures that are consistent with both the above-referenced documents and Energy Commission guidelines.

The goal of these conditions of certification is to provide the minimum level of security for power plants needed to protect California’s electrical infrastructure from malicious mischief, vandalism, or domestic/foreign terrorist attacks. The level of security needed for this solar plant is dependent upon the threat imposed, the likelihood of an adversarial attack, the likelihood of success in causing a catastrophic event, and the severity of consequences of that event.

In order to determine the level of security, the Energy Commission staff used an internal vulnerability assessment decision matrix modeled after the U.S. Department of Justice Chemical Vulnerability Assessment Methodology (July 2002), the NERC 2002 guidelines, the U.S. Department of Energy VAM-CF model, and U.S. Department of Homeland Security regulations published in the Federal Register (Interim Final Rule 6 CFR Part 27). Staff determined that the Calico Solar Project would fall into the “low vulnerability” category, so staff proposes that certain security measures be implemented but does not propose that the project owner conduct its own vulnerability assessment.

These security measures include perimeter fencing and breach detectors, guards (if appropriate), alarms, site access procedures for employees and vendors, site personnel background checks, and law enforcement contact in the event of a security breach. Site access for vendors would be strictly controlled. Consistent with current state and federal regulations governing the transport of hazardous materials, hazardous materials vendors would have to maintain their transport vehicle fleets and employ only drivers who are properly licensed and trained. The project owner would be required, through its contractual language with vendors, to ensure that vendors supplying hazardous materials strictly adhere to the U.S. DOT requirements that hazardous materials vendors prepare and implement security plans per 49 CFR 172.802 and ensure that all hazardous materials drivers are in compliance with personnel background security checks per 49 CFR Part 1572, Subparts A and B. The CPM or the BLM Authorized Safety Officer may authorize modifications to these measures, or may require additional measures in response to additional guidance provided by the U.S. Department of Homeland Security, the U.S. Department of Energy, or NERC, after consultation with appropriate law enforcement agencies and the applicant.

C.5.4.3 CEQA LEVEL OF SIGNIFICANCE

Cumulative Impacts and Mitigation

Staff considered the potential for impacts due to a simultaneous release of any of the hazardous chemicals from the proposed Calico Solar Project with any other existing or foreseeable nearby facilities. Because of the small amounts of the hazardous chemicals to be stored at the facility, staff determined that there was no possibility of producing an offsite impact. Because of this determination, and the additional fact that there are no nearby facilities using large amounts of hazardous chemicals, there is no possibility that vapor plumes would mingle (combine) to produce an airborne concentration that would present a significant risk (pursuant to CEQA). Therefore, no potential cumulative impacts are predicted for the proposed action.

Compliance With LORS

Staff concludes that construction and operation of the Calico Solar Project would be in compliance with all applicable LORS for both long-term and short-term project impacts in the area of hazardous materials management.

Noteworthy Public Benefits

Staff has not identified any noteworthy public benefits associated with the use of hazardous materials at the proposed project.

C.5.5 REDUCED ACREAGE ALTERNATIVE

The Reduced Acreage alternative would essentially be a 275 MW solar facility located within the central portion of the proposed 850 MW project. It was developed because it can be constructed as to minimize potential impacts to environmental resources. This alternative is illustrated in Alternatives Figure 1.

C.5.5.1 SETTING AND EXISTING CONDITIONS

The Reduced Acreage alternative would not significantly change the distance from hazardous materials (i.e. hydrogen storage) to the nearest residences and thus would not change the potential for impact due to proximity as compared to the proposed project. The local meteorology, terrain characteristics, and location of population centers and sensitive receptors relative to the project would remain the same. Please see the discussion of existing conditions within affected BLM lands under Section C.5.4.1

C.5.5.2 ASSESSMENT OF IMPACTS AND DISCUSSION OF MITIGATION

The types of construction and operational impacts of the Reduced Acreage Alternative would be the same as those of the proposed project, as described in Section C.5.4.2. For the analysis, staff examines plausible potential loss of containment incidents (spills) for the hazardous materials to be used at the proposed facility. The proposed project analysis considers the worst case, plausible event, and the impacts are found to be less than significant (pursuant to CEQA) with the incorporation of conditions of certification. The impacts of this alternative would be even smaller due to the reduce use, handling, storage, or transport of hazardous materials and the smaller number of SunCatchers of the alternative. Construction and operation risk to workers due to the use of hydrogen will be reduced because of the reduced number of SunCatchers.

The Reduced Acreage alternative would not result in any significant change in the potential for impact associated with hazardous materials handling and storage. The proposed project would not pose a significant risk of public impact as a result of an accidental release of hazardous materials. This alternative would not significantly change the risk profile of the facility.

C.5.5.3 CEQA LEVEL OF SIGNIFICANCE

The significance criteria for the Reduced Acreage alternative are the same as the criteria for the proposed project. Like the proposed project, the construction and operation of the Reduced Acreage alternative would be in compliance with all applicable LORS for both long-term and short-term project impacts in the area of hazardous materials management with the adoption of the proposed conditions of certification. The mitigation that would be proposed for the Reduced Acreage alternative would be the same as that proposed for the proposed project (staff recommended conditions **HAZ-1** to **HAZ-6**).

C.5.6 AVOIDANCE OF DONATED AND ACQUIRED LANDS ALTERNATIVE

The Avoidance of Donated and Acquired Lands Alternative would be an approximately 720 MW solar facility located within the boundaries of the proposed 850 MW project. This alternative, the transmission line, substation, laydown, and control facilities are shown in **Alternatives Figure 2**.

C.5.6.1 SETTING AND EXISTING CONDITIONS

The Avoidance of Donated land alternative would not significantly change the distance form hazardous materials (i.e. hydrogen storage) to the nearest residences and thus would not change the potential for impact due to proximity as compared to the proposed project. The local meteorology, terrain characteristics, and location of population centers and sensitive receptors relative to the project would remain the same. Please see the discussion of existing conditions within affected BLM lands under Section C.5.4.1.

C.5.6.2 ASSESSMENT OF IMPACTS AND DISCUSSION OF MITIGATION

The types of construction and operational impacts of the Avoidance of Donated land alternative would be the same as those of the proposed project, as described in Section C.5.4.2. For the analysis, staff examines plausible potential loss of containment incidents (spills) for the hazardous materials to be used at the proposed facility. The proposed project analysis considers the worst case, plausible event, and the impacts are found to be less than significant (pursuant to CEQA) with the incorporation of conditions of certification. The impacts of this alternative would be even smaller due to the reduce use, handling, storage, or transport of hazardous materials and the smaller number of SunCatchers of the alternative. Construction and operation risk to workers due to the use of hydrogen will be reduced because of the reduced number of SunCatchers.

The Avoidance of Donated Land alternative would not result in any significant change in the potential for impact associated with hazardous materials handling and storage. The proposed project would not pose a significant risk of public impact as a result of an accidental release of hazardous materials. This alternative would not significantly change the risk profile of the facility.

C.5.6.3 CEQA LEVEL OF SIGNIFICANCE

The significance criteria for the Avoidance of Donated land alternative is exactly the same as the significance criteria for the proposed project. Like the proposed project, the construction and operation of the Avoidance of Donated land alternative would be in compliance with all applicable LORS for both long-term and short-term project impacts in the area of hazardous materials management with the adoption of the proposed conditions of certification. The mitigation that would be proposed for the Avoidance of Donated land alternative would be the same as that proposed for the proposed project (staff recommended conditions **HAZ-1** to **HAZ-6**).

C.5.7 NO PROJECT/NO ACTION ALTERNATIVE

There are three No Project/No Action Alternatives evaluated in this section, as follows:

NO PROJECT/NO ACTION ALTERNATIVE #1:

No Action on the Calico Solar Project application and on CDCA land use plan amendment

Under this alternative, the proposed the Calico Solar Project would not be approved by the CEC and BLM and BLM would not amend the CDCA Plan. As a result, no solar energy project would be constructed on the project site and BLM would continue to manage the site consistent with the existing land use designation in the CDCA Land Use Plan of 1980, as amended.

Because there would be no amendment to the CDCA Plan and no solar project approved for the site under this alternative, it is expected that the site would continue to remain in its existing condition, with no new structures or facilities constructed or operated on the site. As a result, no hazardous materials would be used and no impacts related to the use of hazardous material would occur. However, the land on which the project is proposed would become available to other uses that are consistent with BLM's land use plan, including another solar project requiring a land use plan amendment. In addition, in the absence of this project, other renewable energy projects may be constructed to meet State and Federal mandates, and those projects would have similar impacts in other locations

NO PROJECT/NO ACTION ALTERNATIVE #2:

No Action on the Calico Solar Project and amend the CDCA land use plan to make the area available for future solar development

Under this alternative, the proposed the Calico Solar Project would not be approved by the CEC and BLM and BLM would amend the CDCA Land Use Plan of 1980, as amended, to allow for other solar projects on the site. As a result, it is possible that another solar energy project could be constructed on the project site.

Because the CDCA Plan would be amended, it is possible that the site would be developed with a different solar technology. As a result, construction and operation of the solar technology would likely result in use of hazardous materials. Different solar technologies require the use of different hazardous materials; however, it is expected that all solar technologies would require the use of hazardous materials. As such, this No Project/No Action Alternative could result in impacts to hazardous material handling similar to those under the proposed project.

NO PROJECT/NO ACTION ALTERNATIVE #3:

No Action on the Calico Solar Project application and amend the CDCA land use plan to make the area unavailable for future solar development

Under this alternative, the proposed the Calico Solar Project would not be approved by the CEC and BLM and the BLM would amend the CDCA Plan to make the proposed site unavailable for future solar development. As a result, no solar energy project would be constructed on the project site and BLM would continue to manage the site consistent with the existing land use designation in the CDCA Land Use Plan of 1980, as amended.

Because the CDCA Plan would be amended to make the area unavailable for future solar development, it is expected that the site would continue to remain in its existing condition, with no new structures or facilities constructed or operated on the site and no use of hazardous materials. As a result, this No Project/No Action Alternative would not result in impacts from the use of hazardous materials. However, in the absence of this project, other renewable energy projects may be constructed to meet State and Federal mandates, and those projects would have similar impacts in other locations.

C.5.8 PROJECT-RELATED FUTURE ACTIONS - HAZARDOUS MATERIALS MANAGEMENT

This section examines the potential impacts of future transmission line construction, line removal, substation expansion, and other upgrades that may be required by Southern California Edison Company (SCE) as a result of the Calico Solar Project. The SCE upgrades are a reasonably foreseeable event if the Calico Solar Project is approved and constructed as proposed.

The SCE project will be fully evaluated in a future EIR/EIS prepared by the BLM and the California Public Utilities Commission. Because no application has yet been submitted and the SCE project is still in the planning stages, the level of impact analysis presented is based on available information. The purpose of this analysis is to inform the Energy Commission and BLM, interested parties, and the general public of the potential environmental and public health effects that may result from other actions related to the Calico Solar project.

The project components and construction activities associated with these future actions are described in detail in Section B.3 of this Staff Assessment/EIS. This analysis examines the construction and operational impacts of two upgrade scenarios:

- The **275 MW Early Interconnection Option** would include upgrades to the existing SCE system that would result in 275 MW of additional latent system capacity. Under the 275 MW Early Interconnection option, Pisgah Substation would be expanded adjacent to the existing substation, one to two new 220 kV structures would be constructed to support the gen-tie from the Calico Solar Project into Pisgah Substation, and new telecommunication facilities would be installed within existing SCE ROWs.
- The **850 MW Full Build-Out Option** would include replacement of a 67-mile 220 kV SCE transmission line with a new 500 kV line, expansion of the Pisgah Substation at a new location and other telecommunication upgrades to allow for additional transmission system capacity to support the operation of the full Calico Solar Project.

C.5.8.1 ENVIRONMENTAL SETTING

The environmental setting described herein incorporates both the 275 MW Early Interconnection and the 850 MW Full Build-Out options. The setting for the 275 MW Early Interconnection upgrades at the Pisgah Substation and along the telecomm corridors is included within the larger setting for the project area under the 850 MW Full Build-Out option, which also includes the Lugo-Pisgah transmission corridor.

A hazardous material is generally described as any substance or mixture of substances that have properties that are capable of having an adverse effect on human health and the environment. Hazardous materials handling is regulated at the federal, state, and local level. Regulations cover the transportation, labeling, handling, storage, disposal, and accidental releases of hazardous materials. Included within these regulations are reporting requirements for hazardous materials storage and usage, worker exposure protection, and reporting and spill response requirements. Hazardous material handling also covers response to incidental discovery of buried or unknown hazardous materials present in the subsurface environment.

The general population includes many sensitive subgroups that may be at a greater health risk from exposure to emitted pollutants. These sensitive subgroups include the very young, the elderly, and those with existing illnesses. In addition, the location of the population in the area surrounding a project site may have a large bearing on health risk. The Lugo-Pisgah transmission line route would traverse a combination of developed urban lands on the west end, and relatively undeveloped or limited development areas of the Mojave Desert in the central and eastern sections near Pisgah Substation. The developed areas of the project area have a higher potential to pass through areas of historic or on-going soil or groundwater contamination. The desert and rural areas of the transmission line route would generally be considered lower risk for the presence of hazardous material storage areas or subsurface uncontrolled hazardous waste disposal areas, due to the lack of commercial and industrial activities.

C.5.8.2 ENVIRONMENTAL IMPACTS

Construction activities for both upgrade options would include the handling and use of hazardous materials associated with general construction activities, such as heavy equipment operations, substation expansion, transmission tower construction, and transmission line conductoring and decommissioning. Hazardous materials, such as fuels, oils, and other vehicle and equipment maintenance fluids, would be stored at the project substation sites and construction staging areas. Improperly maintained vehicles and equipment could leak fluids during construction activities and while parked. There would be a potential for incidents involving release of gasoline, diesel fuel, oil, hydraulic fluid, solvents, paint, and/or lubricants from vehicles or other equipment at the staging areas and/or the project sites. Spills and leaks of hazardous materials during construction activities could potentially result in soil or groundwater contamination. Improper handling of hazardous materials could expose project workers or the nearby public to hazards.

Transmission line and telecomm construction activities are generally mobile, moving from one site to another for construction of towers, stringing of lines, and decommissioning equipment. As a mobile construction activity, there would not typically be any centralized fueling or equipment maintenance areas constructed to support the transmission line construction operation. Therefore most of the hazardous materials would be contained within vehicles and small volume containers. Typically vehicle fueling and maintenance activities would occur at off-site facilities.

In addition, although polychlorinated biphenyls (PCB) have been banned from use with electrical distribution and substation transformers by the U.S. EPA since 1985 (U.S. EPA 2009), some older pieces of electrical equipment within SCE's system may still contain PCBs. There is a likelihood that some PCB containing equipment would need to be removed from some of the project locations during the construction of the project and removal of the existing line. Therefore, there would be a potential for a PCB release to contaminate the environment in the event of a spill while handling and transporting PCBs.

Excavation required to construct the components of the project would primarily be limited to areas at existing and proposed structure locations, at underground fiber optic trench locations, and at the expanded Pisgah Substation locations. A contamination site record search would need to be conducted to determine existing known contaminated sites in the project vicinity. Therefore, it is possible that subsurface construction activities could accidentally disturb documented contamination sites, potentially mobilizing soil and/or groundwater contamination.

Finally, previously undocumented soil and or groundwater contamination could be encountered during tower and pole installation, trenching, grading, or other excavation related activities despite the steps taken to identify and avoid contamination.

The presence of oil in a quantity greater than 1,320 gallons invokes Spill Prevention Control and Countermeasures (SPCC) regulations. The quantity of oil contained in any one of the planned 500/220 kV transformers would be in excess of the minimum quantity that requires such regulations.

C.5.8.3 MITIGATION

To identify and avoid documented contamination sites relative to the project sites, record searches specifically for the project locations would need to be conducted. Implementation of mitigation measures should require identification and avoidance of documented contamination sites, thus ensuring that the potential impacts caused by documented contaminated sites would be reduced to less than significant levels.

Soils testing should be conducted and analyzed by a professional, licensed Geotechnical Engineer or Geologist, to determine existing soil conditions. Borings in a sufficient quantity to adequately gather variations in the site soils should be conducted to remove sample cores for testing. The type of soils, soil pressure, relative compaction, resistivity, and percolation factor are among the items that should be tested for. If contaminants are encountered, special studies and remediation measures in compliance with environmental regulations should be implemented by qualified professionals.

During trenching, grading, or excavation work, mitigation measures should be developed that would require the contractor to observe the exposed soil for visual evidence of contamination. If visual contamination indicators are observed during construction, the contractor should be required to stop work until the material is properly characterized and appropriate measures are taken to protect human health and the environment. The contractor would also have to comply with the all local, State, and federal requirements for sampling and testing, and subsequent removal, transport, and disposal of hazardous materials.

All project personnel should be trained on the handling, storage, disposal, and reporting requirements for hazardous materials. All training activities should be completed in compliance with appropriate regulatory requirements. All training activities should be documented and records of training activities maintained for the project for all employees and contractors. Training activities should include appropriate spill response and containment plans.

All hazardous material storage areas and disposal areas should be constructed and operated in compliance with appropriate federal, state, and local regulations. All permits for handling of hazardous materials should be acquired prior to initiation of project activities and should be maintained at the project site. Appropriate spill response and containment plans should be maintained at the project site.

Helicopter fueling, if necessary, should occur at staging areas or at a local airport using the helicopter contractor's fuel truck, should be supervised by the helicopter fuel service provider, and Storm Water Pollution Prevention Plan (SWPPP) measures should be followed, as applicable. The helicopter and fuel truck would likely stay overnight at a local airport or at a staging area if adequate security is in place.

Pisgah Substation Expansion (850 MW Full Build-Out). SCE would follow SPCC regulations and the control of oils spills through secondary containment would be designed by a licensed California Registered Professional Engineer. Permanent or temporary SPCC measures should be in place prior to the delivery of transformers to the site. Improvements may consist of, but not be limited to, trenches, holding areas, retention basins and curbs. An SPCC plan would be prepared and maintained on-site. Substation operating personnel should be trained in the execution of the plan.

C.5.8.4 CONCLUSION

Implementing mitigation measures similar to the Conditions of Certification that are proposed in the Staff Assessment/EIS for construction of the Calico Solar Project, and implementation of SWPPP and a SPCC plans would avoid potential significant hazard impacts from work associated with the SCE upgrade options.

C.5.9 CUMULATIVE IMPACT ANALYSIS

A project may result in significant adverse cumulative impacts (pursuant to CEQA) when its effects are "cumulatively considerable." Cumulatively considerable means that the incremental effects of an individual project are significant (pursuant to CEQA) when viewed in connection with the effects of past projects, the effects of other current projects, or the effects of probable future projects. (Title 14, California Code of Regulations, section 15130). NEPA states that cumulative effects can result from individually minor but significant actions taking place over a period of time (40 CFR § 1508.7).

As discussed in section C.5.4.3 above, staff considered the potential for impacts due to a simultaneous release of any of the hazardous chemicals from the proposed the Calico Solar Project with any other existing or foreseeable nearby facilities. Because of the small amounts and low hazard of the hazardous chemicals to be stored at the facility, Staff determined that there was no possibility of producing an offsite impact. Because of this determination, and the additional fact that there are no nearby facilities using large amounts of hazardous chemicals, there is no possibility that vapor plumes would mingle (combine) to produce an airborne concentration that would present a significant risk (pursuant to CEQA).

Section B.3, Cumulative Scenario, provides detailed information on the potential cumulative solar and other development projects in the project area. Together, these projects comprise the cumulative scenario which forms the basis of the cumulative impact analysis for the proposed project. In summary, these projects are:

- Renewable energy projects on BLM, State, and private lands, as shown on **Cumulative Figures 1 and 2** and in **Cumulative Tables 1A and 1B.** Although not all of those projects are expected to complete the environmental review processes, or be funded and constructed, the list is indicative of the large number of renewable projects currently proposed in California.

These projects are defined within a geographic area that has been identified by the CEC and BLM as covering an area large enough to provide a reasonable basis for evaluating cumulative impacts for all resource elements or environmental parameters. Most of these projects have, are, or will be required to undergo their own independent environmental review under CEQA and/or NEPA. Even if the cumulative projects described in Section B.3 have not yet completed the required environmental processes, they were considered in the cumulative impacts analyses in this SA/Draft EIS.

Geographic Scope of Analysis

The geographic area considered for cumulative impacts from the use of Hazardous Materials is the area within 1 mile of the project boundary. Staff concludes that there is no potential to cause impacts beyond the facility boundary.

For this analysis, no other projects are located close enough to the proposed the Calico Solar Project to cause cumulative impacts on any surrounding population.

Effects of Past and Present Projects

There are no past or currently operating projects in the geographic area that would affect the same area that would be affected by the proposed facility.

Effects of Reasonably Foreseeable Future Projects

There are no reasonably foreseeable future projects in the geographic area that would affect the same area that would be affected by accidental releases at the proposed facility.

Contribution of the Calico Solar Project to Cumulative Impacts

Construction. The Calico Solar Project would not be expected to contribute to the possible short term cumulative impacts related to Hazardous Materials because it is not in close proximity to any other facility that might impact the same surrounding population in the event of an accidental release of hazardous materials.

Operation. The Calico Solar Project would not be expected to the possible long term operational cumulative impacts related to because it is not in close proximity to any other facility that might impact the same surrounding population in the event of an accidental release of hazardous materials.

Decommissioning. The decommissioning of the Calico Solar Project would not be expected to contribute to the possible short term cumulative impacts related to Hazardous Materials, similar to during construction, because it is not in close proximity to any other facility that might impact the same surrounding population in the event of an accidental release of hazardous materials. similar to construction impacts. It is unlikely that the construction or decommissioning of any of the cumulative projects would occur concurrently with the decommissioning of this project, because the decommissioning is not expected to occur for approximately 40 years. As a result, there may not be impacts related to during decommissioning of the Calico Solar Project generated by the cumulative projects. As a result, the impacts of the decommissioning of the Calico Solar Project would not be expected to contribute to cumulative impacts related to Hazardous Materials because all hazardous materials would either continue to be managed within BLM’s framework of a program of multiple use and sustained yield, and the maintenance of environmental quality [43 U.S.C. 1781 (b)] in conformance with applicable statutes, regulations, policy and land use plan.

C.5.10 COMPLIANCE WITH LORS

A discussion of the proposed project’s compliance with LORS applicable to hazardous materials is provided above in subsection C.5.4.3, and **Hazardous Materials Table 1**.

C.5.11 NOTEWORTHY PUBLIC BENEFITS

The proposed project would help in reducing greenhouse gas emissions from gas-fired generation would not occur. Both State and Federal law support the increased use of renewable energy and any resultant decreases in the use of riskier hazardous materials for power production at other facilities.

C.5.12 FACILITY CLOSURE

The requirements for handling hazardous materials remain in effect until such materials are removed from the site, regardless of facility closure. Therefore, the facility owners are responsible for continuing to handle such materials in a safe manner, as required by applicable laws. In the event that the facility owner abandons the facility in a manner that poses a risk to surrounding populations, staff would coordinate with the California Office of Emergency Services, San Bernardino Fire Department, and the California Department of Toxic Substances Control (DTSC) as BLM would be the landowner of the abandoned facility. To ensure that any unacceptable risk to the public is eliminated, Funding for such emergency action as well as site removal, rehabilitation and revegetation activities would be available from a performance bond required of the applicant by BLM.

C.5.13 PROPOSED CONDITIONS OF CERTIFICATION

HAZ-1 The project owner shall not use any hazardous materials not listed in **Appendix A**, below, or in greater quantities than those identified by chemical name in **Appendix A,** unless approved in advance by the BLM's authorized officer and Compliance Project Manager (CPM).

Verification: The project owner shall provide to BLM's authorized officer and the CPM in the Annual Compliance Report, a list of hazardous materials contained at the facility.

HAZ-2 The project owner shall concurrently provide a Hazardous Materials Business Plan (HMBP), a Risk Management Plan (RMP), and a Spill Prevention, Control, and Countermeasure Plan (SPCC) to the San Bernardino County Fire Department, BLM's authorized officer and the CPM for review. After receiving comments from the San Bernardino County Fire Department, BLM's authorized officer and the CPM, the project owner shall reflect all received recommendations in the final documents. If no comments are received from the county within 30 days of submittal, the project owner may proceed with preparation of final documents upon receiving comments from BLM's authorized officer and the CPM. Copies of the final HMBP, RMP, and SPCC Plan shall then be provided to the San Bernardino County Fire Department for their records and to the BLM's authorized officer and CPM for approval.

Verification: At least 60 days prior to receiving any hazardous material on the site for commissioning or operations, the project owner shall provide a copy of a final Hazardous Materials Business Plan (HMBP), a Risk Management Plan (RMP), and a Spill Prevention, Control, and Countermeasure Plan (SPCC) to BLM's authorized officer and the CPM for approval.

HAZ-3 The project owner shall develop and implement a Safety Management Plan for delivery of liquid and gaseous hazardous materials. The plan shall include procedures, protective equipment requirements, training and a checklist. It shall also include a section describing all measures to be implemented to prevent mixing of incompatible hazardous materials. This plan shall be applicable during construction, commissioning, and operation of the power plant.

Verification: At least sixty (60) days prior to the delivery of any liquid or gaseous hazardous material to the facility, the project owner shall provide a Safety Management Plan as described above to BLM's authorized officer and the CPM for review and approval.

HAZ-4 At least thirty (30) days prior to commencing construction, a site-specific Construction Site Security Plan for the construction phase shall be prepared and made available to BLM's authorized officer and the CPM for review and approval. The Construction Security Plan shall include the following:

1. Perimeter security consisting of fencing enclosing the construction area;
2. Security guards;
3. Site access control consisting of a check-in procedure or tag system for construction personnel and visitors;
4. Written standard procedures for employees, contractors and vendors when encountering suspicious objects or packages on-site or off-site;
5. Protocol for contacting law enforcement and the CPM in the event of suspicious activity or emergency; and
6. Evacuation procedures.

Verification: At least thirty (30) days prior to commencing construction, the project owner shall notify BLM's authorized officer and the CPM that a site-specific Construction Security Plan is available for review and approval.

HAZ-5 The project owner shall prepare a site-specific Security Plan for the operational phase and shall be made available to BLM's authorized officer and the CPM for review and approval. The project owner shall implement site security measures addressing physical site security and hazardous materials storage. The level of security to be implemented shall not be less than that described below (as per NERC 2002).

The Operation Security Plan shall include the following:

1. Permanent full perimeter fence, at least 8 feet high around the Solar Field;
2. Main entrance security gate, either hand operable or motorized;
3. Evacuation procedures;
4. Protocol for contacting law enforcement and the CPM in the event of suspicious activity or emergency;
5. Written standard procedures for employees, contractors and vendors when encountering suspicious objects or packages on-site or off-site;
6. a. A statement (refer to sample, attachment "A") signed by the project owner certifying that background investigations have been conducted on all project personnel. Background investigations shall be restricted to ascertain the accuracy of employee identity and employment history, and shall be conducted in accordance with state and federal law regarding security and privacy;

   b. A statement(s) (refer to sample, attachment "B") signed by the contractor or authorized representative(s) for any permanent contractors or other technical contractors (as determined by the CPM after consultation with the project owner) that are present at any time on the site to repair, maintain, investigate, or conduct any other technical duties involving critical components (as determined by the

CPM after consultation with the project owner) certifying that background investigations have been conducted on contractor personnel that visit the project site.

7. Site access controls for employees, contractors, vendors, and visitors;

8. Closed circuit TV (CCTV) monitoring system, recordable, and viewable in the power plant control room and security station (if separate from the control room) with cameras able to pan, tilt, and zoom, have low-light capability, and are able to view the outside entrance to the control room and the front gate; and

9. Additional measures to ensure adequate perimeter security consisting of either:

   a. Security guard present 24 hours per day, 7 days per week, **OR**

   b. Power plant personnel on-site 24 hours per day, 7 days per week and **one** of the following:

      1) The CCTV monitoring system required in number 8 above shall include cameras that are able to view 100% of the perimeter fence, the outside entrance to the control room, and the front gate from a monitor in the power plant control room; **or**

      2) Perimeter breach detectors **or** on-site motion detectors along the entire facility fence line.

The project owner shall fully implement the security plans and obtain BLM's authorized officer and CPM approval of any substantive modifications to the security plans. BLM's authorized officer and the CPM may authorize modifications to these measures, or may require additional measures, such as protective barriers for critical power plant components (e.g., transformers, gas lines, compressors, etc.) depending on circumstances unique to the facility or in response to industry-related standards, security concerns, or additional guidance provided by the U.S. Department of Homeland Security, the U.S. Department of Energy, or the North American Electrical Reliability Council, after consultation with appropriate law enforcement agencies and the applicant.

Verification: At least 30 days prior to the initial receipt of hazardous materials on-site, the project owner shall notify BLM's authorized officer and the CPM that a site-specific Operations Site Security Plan is available for review and approval. In the Annual Compliance Report, the project owner shall include a statement that all current project employee and appropriate contractor background investigations have been performed, and updated certification statements are appended to the Operations Security Plan. In the Annual Compliance Report, the project owner shall include a statement that the Operations Security Plan includes all current hazardous materials transport vendor certifications for security plans and employee background investigations.

HAZ-6 The holder (project owner) shall comply with all applicable Federal laws and regulations existing or hereafter enacted or promulgated. In any event, the holder(s) shall comply with the Toxic Substances Control Act of 1976, as amended (15 U.S.C. 2601, et seq.) with regard to any toxic substances that are used, generated by or stored on the right-of-way or on facilities authorized under this right-of-way grant. (See 40 CFR, Part 702-799 and especially, provisions on polychlorinated biphenyls, 40 CFR 761.1-761.193.) Additionally, any release of toxic substances (leaks, spills, etc.) in excess of the reportable quantity established by 40 CFR, Part 117 shall be reported as required by the Comprehensive Environmental Response, Compensation and Liability Act of 1980, Section 102b

Verification: A copy of any report required or requested by any Federal agency or State government as a result of a reportable release or spill of any toxic substances shall be furnished to BLM's authorized officer and the CPM concurrent with the filing of the reports to the involved Federal agency or State government.

C.5.14 CONCLUSIONS

Staff's evaluation of the proposed project (with proposed mitigation measures) indicates that hazardous material use, storage, and transportation would not pose a significant (pursuant to CEQA) impact on the public. Staff's analysis also shows that there would be no significant (pursuant to CEQA) cumulative impact. With adoption of the proposed conditions of certification, the proposed project would comply with all applicable LORS. Other proposed conditions of certification address the issues of site security matters.

Staff recommends that the Energy Commission impose the proposed conditions of certification, presented below, to ensure that the project is designed, constructed, and operated in compliance with applicable LORS, and would protect the public from significant risk (pursuant to CEQA) of exposure to an accidental release of hazardous materials. If all mitigation proposed by the applicant and by staff are implemented, the use, storage, and transportation of hazardous materials would not present a significant risk (pursuant to CEQA) to the public.

Staff concludes that there is insignificant potential for hazardous materials release to have significant impact beyond the facility boundary, and therefore concludes there is also insignificant potential for significant (pursuant to CEQA) impact to the environment. For any other potential impacts upon the environment, including vegetation, wildlife, air, soils, and water resulting from hazardous materials usage and disposal at the proposed facility, the reader is referred to the **Biology**, the **Air Quality**, the **Soil and Water**, and the **Waste Management** sections of this SA/DEIS.

Staff also concludes that none of the alternatives to the proposed project would materially or significantly change the impacts associated with hazardous materials handling. None of the alternatives would be preferred to the proposed project or reduce any otherwise significant (pursuant to CEQA) impacts caused by hazardous materials handling.

Staff proposes six conditions of certification, some of which are mentioned in the text (above), and listed below. **HAZ-1** ensures that no hazardous material would be used at the facility except as listed in the AFC, unless there is prior approval by the Energy Commission Compliance Project Manager (CPM) and the BLM Authorized Safety

Officer. **HAZ-2** ensures that local emergency response services are notified of the amounts and locations of hazardous materials at the facility, **HAZ-3** requires the development of a Safety Management Plan that addresses the delivery of all liquid or gaseous hazardous materials during the construction, commissioning, and operation of the project would further reduce the risk of any accidental release not specifically addressed by the proposed spill prevention mitigation measures, and further prevent the mixing of incompatible materials that could result in the generation of toxic vapors. Site security during both the construction and operation phases is addressed in **HAZ-4** and **HAZ-5. HAZ-6** ensures that the applicant complies with all Federal LORS regarding use, management, spills, and reporting of hazardous materials on Federal lands.

SAMPLE CERTIFICATION (Attachment "A")

Affidavit of Compliance for Project Owners

I, ____

(Name of person signing affidavit)(Title)

do hereby certify that background investigations to ascertain the accuracy of the identity and employment history of all employees of

____

(Company Name)

for employment at

____

(Project name and location)

have been conducted as required by the U.S. Bureau of Land Management Right-of-Way and California Energy Commission Decision for the above- named project.

____

(Signature of Officer or Agent)

Dated this ____________________ day of ____________________, 20 _______.

THIS AFFIDAVIT OF COMPLIANCE SHALL BE APPENDED TO THE PROJECT SECURITY PLAN AND SHALL BE RETAINED AT ALL TIMES AT THE PROJECT SITE FOR REVIEW BY BLM's AUTHORIZED OFFICER AND THE CALIFORNIA ENERGY COMMISSION COMPLIANCE PROJECT MANAGER.

SAMPLE CERTIFICATION (Attachment "B")

Affidavit of Compliance for Contractors

I, ____

(Name of person signing affidavit)(Title)

do hereby certify that background investigations to ascertain the accuracy of the identity and employment history of all employees of

____

(Company Name)

for contract work at

____

(Project name and location)

____

(Signature of Officer or Agent)

Dated this ____________________ day of ____________________, 20 ________.

THIS AFFIDAVIT OF COMPLIANCE SHALL BE APPENDED TO THE PROJECT SECURITY PLAN AND SHALL BE RETAINED AT ALL TIMES AT THE PROJECT SITE FOR REVIEW BY BLM's AUTHORIZED OFFICER AND THE CALIFORNIA ENERGY COMMISSION COMPLIANCE PROJECT MANAGER.

C.5.15 REFERENCES

AIChE (American Institute of Chemical Engineers) 1989 – *Guidelines for Technical Management of* Chemical *Process Safety*, AIChE, New York, NY 10017.

AIChE (American Institute of Chemical Engineers) 1994 – *Guidelines for Implementing Process Safety* Management *Systems*, AIChE, New York, NY 10017.

API (American Petroleum Institute) 1990 – *Management of Process Hazards, API Recommended* Practice *750*; American Petroleum Institute, First Edition, Washington, DC, 1990.

Davies, P. A. and Lees, F. P. 1992 – *The Assessment of Major Hazards: The Road Transport* Environment *for Conveyance of Hazardous Materials in Great Britain*. Journal of Hazardous Materials, 32: 41-79.

Environmental Protection Agency (US EPA) 2000a – *Chemical Accident Prevention: Site Security* Environmental Protection Agency, Office of Solid Waste and Emergency Response. February 2000.

Harwood, D. W., Viner, J. G., and E. R. Russell 1990 – *Truck Accident Rate Model for Hazardous Materials Routing*. Transportation Research Record. 1264: 12-23.

Harwood, D. W., Viner, J. G., and E. R. Russell 1993 – *Procedure for Developing Truck Accident and Release Rates for Hazmat Routing*. Journal of Transportation Engineering. 119(2): 189-199.

Lees, F. P. 1998 – *Loss* Prevention *in the Process Industries*, Vols. I, II and III. Second Edition, Butterworths.

National Response Center Database. U.S. Coast Guard. 2002

National Transportation Safety Board Database. U.S. Department of Transportation. 2001

North American Electric Reliability Corporation (NERC) 2002 – *Security Guidelines for the Electricity* Sector*,* version 1.0, June 14, 2002.

NRC (National Research Council) 1979 – *Ammonia. Subcommittee on Ammonia. Committee on* Medical *and Biologic Effects of Environmental Pollutants*. Division of Medical Sciences, Assembly of Life Sciences, National Research Council (NRC), Baltimore, Maryland, University Park Press (NTIS No. PB 278-027).

Pet-Armacost, J. J., Sepulveda, J. and M. Sakude 1999 – *Monte Carlo Sensitivity Analysis of Unknown Parameters in Hazardous Materials Transportation Risk Assessment.* Risk Analysis. 19(6): 1173-1184.

Rhyne, W. R. 1994 – Hazardous Materials Transportation Risk Analysis. Quantitative Approaches for Truck and Train. Chapter 2: Transportation Quantitative Risk Analysis; and Chapter 3: Databases

SES (Stirling Energy Systems Solar Three and Solar Six, LLC) 2008a – Application for Certification for the Stirling Energy Systems (SES) Solar One Project, Volumes 1 and 2. Submitted to the California Energy Commission, December 1, 2008.

SES 2008d – Supplement to the Application for Certification for the SES Solar Two Project. Submitted to the California Energy Commission, September 28, 2008.

U.S. Department of Energy (US DOE) 2002 – Draft Vulnerability Ass, assessment Methodology, Electric Power Infrastructure. Office of Energy Assurance, September 30, 2002.

OSHA (United States Occupational Safety and Health Administration) 1993 – *Process Safety* Management / *Process Safety Management Guidelines for Compliance*. U.S. Department of Labor, Washington, DC.

Vilchez, J. A., Sevilla, S., Montiel, H. and J. Casal 1995 – *Historical Analysis of Accidents in Chemical Plants and in the Transportation of Hazardous Materials*. J. Loss Prev. Process Ind. 8(2): 87-96.

Hazardous Materials Appendix A
Hazardous Materials Proposed for Use at Calico Solar

Hazardous Materials Usage and Storage During Operations				
Chemical	**Use**	**Storage Location/Type**	**State**	**Storage Quantity**
Insulating oil	Electrical equipment	Electrical equipment (contained in transformers and electrical switches)	Liquid	60,000 gallons initial fill
Lubricating oil	Stirling Engine/dish drives PCU	Equipment 150-gallon recycle tank located in Maintenance Building	Liquid	40,000 gallons initial fill with usage of 21 gallons per month
Hydrogen	PCU working fluid	Generated on-site and stored in pressure vessel	Gas	7,162,148 scf (~37,243 lbs)
Acetylene	Welding	Cylinders stored in maintenance buildings	Gas	1,000 cubic feet
Oxygen	Welding	Cylinders stored in maintenance buildings	Gas	1,000 cubic feet
Ethylene glycol	PCU Radiator Coolant, antifreeze	PCU radiator Maintenance Buildings	Liquid	40,000 gal initial fill with usage of 21 gallons per month
Various solvents, detergents, paints, and other cleaners	Building maintenance and equipment cleaning	Three (3) 55-gallon drums and 1-gallon containers will be stored Maintenance Buildings	Liquid	Ten (10) 55-gallon drums Commercial 1-gallon containers
Gasoline	Maintenance vehicles	5,000 gallon AST at refueling station with containment	Liquid	5,000 gallons
Diesel fuel	Firewater pump Maintenance Vehicles	Firewater skid 5,000-gallon AST refueling station with containment	Liquid	100 gallons initial fill 5,000 gallons
Sodium hypochlorite 12.5% solution (bleach)	Disinfectant for potable water	Water treatment structure	Liquid	4 gallons

Notes:
AST = aboveground storage tank
PCU = power conversion unit
Source: SES 2008a.

C.6 – PUBLIC HEALTH AND SAFETY

Testimony of Alvin J. Greenberg, Ph.D.

C.6.1 SUMMARY OF CONCLUSIONS

U.S. Bureau of Land Management and Energy Commission staff (hereafter jointly referred to as staff) have analyzed potential public health and safety risks associated with construction and operation of the Calico Solar Project (formerly the Stirling Energy Systems Solar One Project) and does not expect any significant adverse cancer or short- or long-term noncancer health effects from project toxic emissions. Staff's analysis of potential health impacts from the proposed Calico Solar Project uses a conservative health-protective methodology that accounts for impacts to the most sensitive individuals in a given population, including newborns and infants. According to the results of staff's health risk assessment, emissions from the Calico Solar Project, which include only one stationary source (an emergency diesel generator) and a large number of mobile sources (gasoline-fueled and diesel-fueled maintenance and delivery vehicles), would not contribute significantly to morbidity or mortality in any age or ethnic group residing in the project area. Therefore, the impacts on public health from emissions of Toxic Air Contaminants (Hazardous Air Pollutants) according to CEQA and NEPA would be less than significance.

C.6.2 INTRODUCTION

The purpose of this Staff Assessment/Draft Environmental Impact Statement (SA/DEIS) is to determine if emissions of toxic air contaminants (TACs) from the proposed Calico Solar Project would have the potential to cause significant adverse public health and safety impacts or to violate standards for public health protection. If potentially significant health and safety impacts are identified, staff will evaluate mitigation measures to reduce such impacts to insignificant levels.

In addition to the analysis contained in this Public Health and Safety Section that focuses on potential effects to the public from emissions of toxic air contaminants, other related aspects to the assessment of potential public health and safety impacts from the Calico Solar Project are considered elsewhere in this document as listed and briefly described below:

- Air Quality – evaluates the expected air quality impacts from the emissions of criteria air pollutants from both the construction and operation of the Calico Solar Project; Criteria air pollutants are defined as air contaminants for which the state and/or federal governments have established an ambient air quality standard to protect public health;
- Hazardous Materials Management – evaluates the potential impacts on public and worker health from accidental releases of hazardous materials;
- Socioeconomics and Environmental Justice – evaluates project-induced changes on community services including law enforcement and hospitals;
- Soil and Water Resources – evaluates the potential for the Calico Solar Project to cause contamination of soil and water resources, to exacerbate flooding, and to

cause adverse effects to water supply in consideration of other existing users and projected needs;

- Transmission Line Safety and Nuisance – evaluates potential effects associated with proposed transmission lines accounting for both the physical presence of the lines and the physical interactions of their electric and magnetic fields; The potential effects include aviation safety, interference with radio-frequency communication, audible noise, fire hazards, hazardous shocks, nuisance shocks, and electric and magnetic field (EMF) exposure.
- Worker Safety and Fire Protection – assess the worker safety and fire protection measures proposed by the applicant including determining whether the project would have any adverse impacts on fire protection and emergency medical services that are also relied upon by the public;
- Waste Management – evaluates issues associated with wastes generated from the proposed project construction and operation including ensuring that wastes would be managed in an environmentally safe manner.

C.6.3 METHODOLOGY AND THRESHOLDS FOR DETERMINING ENVIRONMENTAL CONSEQUENCES

The analysis of proposed project effects must comply with both CEQA and NEPA requirements given the respective power plant licensing and land jurisdictions of the California Energy Commission and U.S. Bureau of Land Management (BLM). CEQA requires that the significance of individual effects be determined by the Lead Agency; however, the use of specific significance criteria is not required by NEPA.

Because this document is intended to meet the requirements of both NEPA and CEQA, the methodology used for determining environmental impacts of the proposed project includes a consideration of guidance provided by both laws.

CEQA requires a list of criteria that are used to determine the significance of identified impacts. A significant impact is defined by CEQA as “a substantial, or potentially substantial, adverse change in any of the physical conditions within the area affected by the project” (State CEQA Guidelines Section 15382).

In comparison, NEPA states that “‘Significantly’ as used in NEPA requires considerations of both context and intensity…” (40 CFR 1508.27). Therefore, thresholds serve as a benchmark for determining if a project action will result in a significant adverse environmental impact when evaluated against the baseline. NEPA requires that an Environmental Impact Statement (EIS) is prepared when the proposed federal action (project) as a whole has the potential to “significantly affect the quality of the human environment.”

Thresholds for determining significance in this section are based on Appendix G of the CEQA Guidelines (CCR 2006) and performance standards or thresholds identified by the Energy Commission staff. In addition, staff’s evaluation of the environmental effects of the proposed project on land uses (i.e., those listed below) includes an assessment of the context and intensity of the impacts, as defined in the NEPA implementing regulations 40 CFR Part 1508.27.

Effects of the proposed project on the land use environment (and in compliance with both CEQA and NEPA) have been determined using the thresholds listed below.

The **PUBLIC HEALTH** section of this staff assessment discusses toxic emissions to which the public could be exposed during project construction and routine operation. Following the release of toxic contaminants into the air or water, people may come into contact with them through inhalation, dermal contact, or ingestion via contaminated food or water.

Air pollutants for which no ambient air quality standards have been established are called noncriteria pollutants. Unlike criteria pollutants such as ozone, carbon monoxide, sulfur dioxide, or nitrogen dioxide, noncriteria pollutants have no ambient (outdoor) air quality standards that specify levels considered safe for everyone.

Since noncriteria pollutants do not have such standards, a health risk assessment is used to determine if people might be exposed to those types of pollutants at unhealthy levels. The risk assessment consists of the following steps:

- identify the types and amounts of hazardous substances that the Calico Solar Project could emit to the environment;
- estimate worst-case concentrations of project emissions in the environment using dispersion modeling;
- estimate amounts of pollutants that people could be exposed to through inhalation, ingestion, and dermal contact; and
- characterize potential health risks by comparing worst-case exposure to safe standards based on known health effects.

Staff relies upon the expertise of the California Environmental Protection Agency (Cal/EPA) Office of Environmental Health Hazard Assessment (OEHHA) to identify contaminants that are known to the state to cause cancer or other noncancer toxicological endpoints and to calculate the toxicity and cancer potency factors of these contaminants. Staff also relies upon the expertise of the California Air Resources Board and the local air districts to conduct ambient air monitoring of toxic air contaminants and the state Department of Public Health to conduct epidemiological investigations into the impacts of pollutants on communities. It is not within the purview or the expertise of the Energy Commission staff to duplicate the expertise and statutory responsibility of these agencies.

Initially, a screening level risk assessment is performed using simplified assumptions that are intentionally biased toward protection of public health. That is, an analysis is designed that overestimates public health impacts from exposure to project emissions. In reality, it is likely that the actual risks from the power plant will be much lower than the risks as estimated by the screening level assessment. The risks for screening purposes are based on examining conditions that would lead to the highest, or worst-case, risks and then using those conditions in the study. Such conditions include:

- using the highest levels of pollutants that could be emitted from the plant;

- assuming weather conditions that would lead to the maximum ambient concentration of pollutants;
- using the type of air quality computer model which predicts the greatest plausible impacts;
- calculating health risks at the location where the pollutant concentrations are estimated to be the highest;
- assuming that an individual's exposure to cancer-causing agents occurs continuously for 70 years; and
- using health-based standards designed to protect the most sensitive members of the population (i.e., the young, elderly, and those with respiratory illnesses).

A screening level risk assessment will, at a minimum, include the potential health effects from inhaling hazardous substances. Some facilities may also emit certain substances that could present a health hazard from noninhalation pathways of exposure (OEHHA 2003, Tables 5.1, 6.3, 7.1). When these substances are present in facility emissions, the screening level analysis includes the following additional exposure pathways: soil ingestion, dermal exposure, and mother's milk (OEHHA 2003, p. 5-3).

The risk assessment process addresses three categories of health impacts: acute (short-term) health effects, chronic (long-term) noncancer effects, and cancer risk (also long-term). Acute health effects result from short-term (one-hour) exposure to relatively high concentrations of pollutants. Acute effects are temporary in nature and include symptoms such as irritation of the eyes, skin, and respiratory tract.

Chronic health effects are those that arise as a result of long-term exposure to lower concentrations of pollutants. The exposure period is considered to be approximately from 12% to 100% of a lifetime, or from 8 to 70 years (OEHHA 2003, p. 6-5). Chronic health effects include diseases such as reduced lung function and heart disease.

The analysis for noncancer health effects compares the maximum project contaminant levels to safe levels called *Reference Exposure Levels*, or RELs. These are amounts of toxic substances to which even sensitive people can be exposed and suffer no adverse health effects (OEHHA 2003, p. 6-2). These exposure levels are designed to protect the most sensitive individuals in the population, such as infants, the aged, and people suffering from illness or disease which makes them more sensitive to the effects of toxic substance exposure. The Reference Exposure Levels are based on the most sensitive adverse health effect reported in the medical and toxicological literature and include margins of safety. The margin of safety addresses uncertainties associated with inconclusive scientific and technical information available at the time of standard setting and is meant to provide a reasonable degree of protection against hazards that research has not yet identified. The margin of safety is designed to prevent pollution levels that have been demonstrated to be harmful, as well as to prevent lower pollutant levels that may pose an unacceptable risk of harm, even if the risk is not precisely identified as to nature or degree. Health protection is achieved if the estimated worst-case exposure is below the relevant reference exposure level. In such a case, an adequate margin of safety exists between the predicted exposure and the estimated threshold dose for toxicity.

Exposure to multiple toxic substances may result in health effects that are equal to, less than, or greater than effects resulting from exposure to the individual chemicals. Only a small fraction of the thousands of potential combinations of chemicals have been tested for the health effects of combined exposures. In conformity with the California Air Pollution Control Officers Association (CAPCOA) guidelines, the health risk assessment assumes that the effects of each substance are additive for a given organ system (OEHHA 2003, pp. 1-5, 8-12). Other possible mechanisms due to multiple exposures include those cases where the actions may be synergistic or antagonistic (where the effects are greater or less than the sum, respectively). For these types of substances, the health risk assessment could underestimate or overestimate the risks.

For carcinogenic substances, the health assessment considers the risk of developing cancer and assumes that continuous exposure to the cancer-causing substance occurs over a 70-year lifetime. The risk that is calculated is not meant to project the actual expected incidence of cancer, but rather a theoretical upper-bound number based on worst-case assumptions.

Cancer risk is expressed in chances per million and is a function of the maximum expected pollutant concentration, the probability that a particular pollutant will cause cancer (called *potency factors* and established by OEHHA), and the length of the exposure period. Cancer risks for each carcinogen are added to yield total cancer risk. The conservative nature of the screening assumptions used means that actual cancer risks due to project emissions are likely to be considerably lower than those estimated.

The screening analysis is performed to assess worst-case risks to public health associated with the proposed project. If the screening analysis predicts no significant risks, then no further analysis is required. However, if risks are above the significance level, then further analysis, using more realistic site-specific assumptions, would be performed to obtain a more accurate assessment of potential public health risks.

Significance Criteria

Energy Commission staff determines the health effects of exposure to toxic emissions based on impacts to the maximum exposed individual. This is a person hypothetically exposed to project emissions at a location where the highest ambient impacts were calculated using worst-case assumptions, as described above.

As described earlier, noncriteria pollutants are evaluated for short-term (acute) and long-term (chronic) noncancer health effects, as well as cancer (long-term) health effects. The significance of project health impacts is determined separately for each of the three categories.

Acute and Chronic Noncancer Health Effects

Staff assesses the significance of noncancer health effects by calculating a *hazard index*. A hazard index is a ratio comparing exposure from facility emissions to the reference (safe) exposure level. A ratio of less than 1.0 signifies that the worst-case exposure is below the safe level. The hazard index for every toxic substance that has the same type of health effect is added to yield a Total Hazard Index. The Total Hazard Index is calculated separately for acute and chronic effects. A Total Hazard Index of less than 1.0 indicates that cumulative worst-case exposures are less than the reference exposure levels. Under these conditions, health protection from the project is likely to be achieved, even for sensitive members of the population. In such a case, staff presumes that there would be no significant noncancer project-related public health impacts.

Cancer Risk

Staff relied upon regulations implementing the provisions of Proposition 65, the Safe Drinking Water and Toxic Enforcement Act of 1986, (Health & Safety Code, §§25249.5 et seq.) for guidance to determine a cancer risk significance level. Title 22, California Code of Regulations section 12703(b) states that "the risk level which represents no significant risk shall be one which is calculated to result in one excess case of cancer in an exposed population of 100,000, assuming lifetime exposure." This level of risk is equivalent to a cancer risk of 10 in 1 million, which is also written as 10×10^{-6}. An important distinction is that the Proposition 65 significance level applies separately to each cancer-causing substance, whereas staff determines significance based on the total risk from all cancer-causing chemicals. Thus, the manner in which the significance level is applied by staff is more conservative (health-protective) than that applied by Proposition 65. The significant risk level of 10 in 1 million is consistent with the level of significance adopted by many air districts. In general, these air districts would not approve a project with a cancer risk exceeding 10 in 1 million.

As noted earlier, the initial risk analysis for a project is typically performed at a screening level, which is designed to overstate actual risks, so that health protection can be ensured. Staff's analysis also addresses potential impacts on all members of the population including the young, the elderly, people with existing medical conditions that may make them more sensitive to the adverse effects of toxic air contaminants, and any minority or low-income populations that are likely to be disproportionately affected by impacts. To accomplish this goal, staff uses the most current acceptable public health exposure levels set to protect the public from the effects of airborne toxics. When a screening analysis shows cancer risks to be above the significance level, refined assumptions would likely result in a lower, more realistic risk estimate. Based on refined assumptions, if risk posed by the facility exceeds the significance level of 10 in 1 million, staff would require appropriate measures to reduce the risk to less than significant. If, after all risk reduction measures had been considered, a refined analysis identifies a cancer risk greater than 10 in 1 million, staff would deem such risk to be significant and would not recommend project approval.

Laws, Ordinances, Regulations, and Standards

PUBLIC HEALTH AND SAFETY Table 1
Laws, Ordinances, Regulations, and Standards (LORS)

Applicable Law	**Description**
Federal	
Clean Air Act section 112 (Title 42, U.S. Code section 7412)	This act requires new sources that emit more than 10 tons per year of any specified Hazardous Air Pollutant (HAP) or more than 25 tons per year of any combination of HAPs to apply Maximum Achievable Control Technology.
State	
California Health and Safety Code section 25249.5 et seq. (Proposition 65)	These sections establish thresholds of exposure to carcinogenic substances above which Prop 65 exposure warnings are required.
California Health and Safety Code section 41700	This section states that “no person shall discharge from any source whatsoever such quantities of air contaminants or other material which cause injury, detriment, nuisance, or annoyance to any considerable number of persons or to the public, or which endanger the comfort, repose, health, or safety of any such persons or the public, or which cause, or have a natural tendency to cause injury or damage to business or property.”
California Public Resource Code section 25523(a); Title 20 California Code of Regulations (CCR) section 1752.5, 2300–2309 and Division 2 Chapter 5, Article 1, Appendix B, Part (1); California Clean Air Act, Health and Safety Code section 39650, et seq.	These regulations require a quantitative health risk assessment for new or modified sources, including power plants that emit one or more toxic air contaminants (TACs).
Local	
Mojave Desert Air Quality Management District (MDAQMD) Rule 1302	New Source Review for Toxic Air Contaminants.

C.6.4 PROPOSED PROJECT

C.6.4.1 SETTING AND EXISTING CONDITIONS

This section describes the environment in the vicinity of the proposed project site from the public health perspective. Characteristics of the natural environment, such as meteorology and terrain, affect the project's potential for causing impacts on public health. An emissions plume from a facility may affect elevated areas before lower terrain areas due to a reduced opportunity for atmospheric mixing. Consequently, areas of elevated terrain can often be subjected to increased pollutant impacts. Also, the types of land use near a site influence the surrounding population distribution and density, which, in turn, affect public exposure to project emissions. Additional factors affecting potential public health impacts include existing air quality, existing health concerns, and environmental site contamination.

Site and Vicinity Description

The project would be located in an undeveloped part of San Bernardino County adjacent to Interstate 40 and about 37 miles east of Barstow. Lands in this part of the Mojave Desert are managed predominantly by the Bureau of Land Management (BLM). Land uses in the vicinity of the proposed project include transportation use, open space, and resource conservation (SES 2008a, Section 5.9.1). There are a total of three residences within a 3-mile radius of the proposed site, the nearest of which is located approximately 1,300 feet south of the property boundary on the other side of I-40. There are no sensitive receptors in the vicinity of the project site (SES 2008a, Section 5.16.1 and Figure 5.16-1).

The site elevation slopes gently to the northeast and ranges from 1,925 to 3,050 feet above sea level (SES 2008a, Section 5.2). Topography in the vicinity of the project is varied in elevation, with regions of elevated terrain existing mostly to the north and east, where the sloping grade continues beyond the project boundary (SES 2008a, Section 5.2.1 and Figure 5.2-1).

Meteorology

Meteorological conditions, including wind speed, wind direction, and atmospheric stability, affect the extent to which pollutants are dispersed into ambient air as well as the direction of pollutant transport. This, in turn, affects the level of public exposure to emitted pollutants and associated health risks. When wind speeds are low and the atmosphere is stable, for example, dispersion is reduced, and localized exposure may be increased.

San Bernardino County is characterized by a high desert climate; summers are hot and dry, winters are moderate with low precipitation, and temperature inversions are strong. Winds generally flow from the west across the region (SES 2008a, Section 5.2.1.1 and Figure 5.2-3).

Atmospheric stability is a measure related to turbulence, or the ability of the atmosphere to disperse pollutants due to convective air movement. Mixing heights (the height above ground level through which the air is well mixed and in which pollutants can be dispersed) are lower during mornings due to temperature inversions and increase during the warmer afternoons. Staff's **AIR QUALITY** section presents more detailed meteorological data.

Existing Air Quality

The proposed site is within the jurisdiction of the Mojave Desert Air Quality Management District (MDAQMD). By examining average toxic air contaminants' concentration levels from representative air monitoring sites with cancer risk factors specific to each contaminant, lifetime cancer risk can be calculated to provide a background risk level for inhalation of ambient air. For comparison purposes, it should be noted that the overall lifetime cancer risk for the average individual in the United States is about 1 in 3, or 333,000 in 1 million.

There are several air quality monitoring stations in San Bernardino County operated by the MDAQMD and the California Air Resources Board (CARB), the closest of which is in Barstow, about 37 miles west of the proposed site. Data from this monitoring station shows that the annual arithmetic mean for PM10 ranged approximately between 22 and 30 $\mu g/m^3$ between the years 2005 and 2008. The annual arithmetic mean for PM2.5 measured at the Victorville monitoring station (about 57 miles southwest) ranged between 9.7 and 10.4 $\mu g/m^3$ between 2006 and 2007 (SES 2008a, Section 5.2.1.2 and Tessera Solar 2009q, General Comment Tables 5.2-3a and 5.2-4 Revised).

The nearest California Air Resources Board (CARB) air toxics monitoring station that actively reports values is located on Mission Boulevard in Riverside, approximately 80 miles southwest of the project site. Although staff does not consider this location to be representative of air quality in the area of the proposed site, it does serve to show the upper-bound levels of toxic air contaminants emitted by all stationary and mobile sources found in the region. In 2008, the background cancer risk calculated by CARB for the Riverside monitoring station was 104 in one million (CARB 2009). The pollutants 1,3-butadiene and benzene, emitted primarily from mobile sources (gasoline-fueled cars and trucks), accounted together for about half of the total risk. The risk from 1,3-butadiene was about 22 in one million at Riverside, while the risk from benzene was about 30 in one million. Formaldehyde accounts for about 20% of the 2008 average calculated cancer risk based on air toxics monitoring results, with a risk of about 21 in one million. Formaldehyde is emitted directly from vehicles and other combustion sources. The risk from hexavalent chromium was about 23 in one million, or ~22% of the total risk. Fifty-one percent of hexavalent chromium in California is emitted from stationary sources with activities such as chrome plating, welding, spray painting, and leather tanning, while mobile sources such as jet aircrafts and ships contribute about 38%.

The use of reformulated gasoline, beginning in the second quarter of 1996, as well as other toxics reduction measures, have led to a decrease of ambient levels of toxics and associated cancer risk during the past few years in all areas of the state and the nation. For example, in the San Francisco Bay Area, cancer risk was 342 in 1 million based on 1992 data, 315 in 1 million based on 1994 data, and 303 in 1 million based on 1995 data. In 2002, the most recent year for which data is available, the average inhalation cancer risk decreased to 162 in 1 million (BAAQMD 2004b, p. 12).

Existing Public Health Concerns

When evaluating a new project, staff often conducts a detailed study and analysis of existing public health issues in the project vicinity. This analysis is prepared in order to identify the current status of respiratory diseases (including asthma), cancer, and childhood mortality rates in the population located near the proposed project. Assessing existing health concerns in the project area will provide staff with a basis on which to evaluate the significance of any additional health impacts from the proposed Calico Solar Project and evaluate any proposed mitigation. Because of the very low population in the immediate vicinity of the project and because no existing health issues within a 6-mile radius of the project have been identified by the applicant (SES 2008a, Section 5.16.1), staff did not conduct an analysis of existing public health issues.

C.6.4.2 ASSESSMENT OF IMPACTS AND DISCUSSION OF MITIGATION

Direct/Indirect Impacts and Mitigation

Proposed Project - Construction Impacts and Mitigation

Potential risks to public health during construction may be associated with exposure to toxic substances in contaminated soil disturbed during site preparation, as well as diesel exhaust from heavy equipment operation. Criteria pollutant impacts from the operation of heavy equipment and particulate matter from earth moving are examined in staff's **AIR QUALITY** analysis.

Site disturbances occur during facility construction from excavation, grading, and earth moving. Such activities have the potential to adversely affect public health through various mechanisms, such as the creation of airborne dust, material being carried off site through soil erosion, and uncovering buried hazardous substances. A Phase I Environmental Site Assessment conducted for this site in 2008 identified no "Recognized Environmental Conditions" per the American Society for Testing and Materials Standards (ASTM) definition. That is, there was no evidence or record of any use, spillage, or disposal of hazardous substances on the site, nor was there any other environmental concern that would require remedial action (SES 2008a, Appendix T Section 7). In the event that any unexpected contamination is encountered during construction, proposed Conditions of Certification **WASTE-1** and **WASTE-2** (which require a registered professional engineer or geologist to be available during soil excavation and grading to ensure proper handling and disposal of contaminated soil) would ensure that contaminated soil does not affect the public. See the staff assessment section on **WASTE MANAGEMENT** for a more detailed analysis of this topic.

The operation of construction equipment will result in air emissions from diesel-fueled engines. Diesel emissions are generated from sources such as trucks, graders, cranes, welding machines, electric generators, air compressors, and water pumps. Although diesel exhaust contains criteria pollutants such as nitrogen oxides, carbon monoxide, and sulfur oxides, it also includes a complex mixture of thousands of gases and fine particles. These particles are primarily composed of aggregates of spherical carbon particles coated with organic and inorganic substances. Diesel exhaust contains over 40 substances that are listed by the U.S. Environmental Protection Agency (U.S. EPA) as hazardous air pollutants and by the California Air Resources Board (ARB) as toxic air contaminants.

Exposure to diesel exhaust may cause both short- and long-term adverse health effects. Short-term effects can include increased coughing, labored breathing, chest tightness, wheezing, and eye and nasal irritation. Long-term effects can include increased coughing, chronic bronchitis, reductions in lung function, and inflammation of the lung. Epidemiological studies also strongly suggest a causal relationship between occupational diesel exhaust exposure and lung cancer.

Based on a number of health effects studies, the Scientific Review Panel on Toxic Air Contaminants recommended a chronic reference exposure level (see discussion of reference exposure levels in Method of Analysis section above) for diesel exhaust particulate matter of 5 micrograms of diesel particulate matter per cubic meter of air ($\mu g/m^3$) and a cancer unit risk factor of $3x10^{-4}$ $(\mu g/m^3)^{-1}$ (SRP 1998, p. 6).[1] The Scientific Review Panel did not recommend a value for an acute Reference Exposure Level since available data in support of a value was deemed insufficient. On August 27, 1998, ARB listed particulate emissions from diesel-fueled engines as a toxic air contaminant and approved the panel's recommendations regarding health effect levels.

Construction of the Calico Solar Project is anticipated to take place over a period of 48 months. Section 5.2.2.1 of the Response to CEC and BLM Data Requests (Tessera Solar 2009q) presents daily and annual maximum emissions of criteria pollutants including fugitive dust and diesel exhaust emissions from construction equipment and worker vehicles. The applicant estimated worst-case emissions of 719 pounds per day of PM10 and 143 pounds per day of PM2.5 during construction, which includes onsite and offsite activities (Tessera Solar 2009q, Table 5.2-9 Revised). The applicant has not estimated the health risks resulting from construction activities due to the short duration of this phase (SES 2008a, Section 5.16.2.2). Staff also did not conduct a quantitative assessment of construction impacts on public health because of the distance to the sparsely populated area surrounding the site and because staff has found numerous times using quantitative risk assessment tools that impacts due to construction vehicle diesel emissions are invariably less than significant even to close-in receptors. Also, as noted earlier, assessment of chronic (long-term) health effects assumes continuous exposure to toxic substances over a significantly longer time period, typically from 8 to 70 years.

Additionally, mitigation measures are proposed by both the applicant and Energy Commission staff to reduce the maximum calculated PM10 and PM2.5 emissions and thus reduce the potential impacts even further. These mitigation measures can be found in the **AIR QUALITY** section of this document and include the use of extensive fugitive dust and diesel exhaust control measures. The fugitive dust control measures are assumed to result in 90% reductions of emissions. In order to further mitigate potential impacts from particulate emissions during the operation of diesel-powered construction

[1] The SRP, established pursuant to California Health and Safety Code section 39670, evaluates the risk assessments of substances proposed for identification as Toxic Air Contaminants by ARB and the Department of Pesticide Regulation (DPR). The SRP reviews the exposure and health assessment reports and the underlying scientific data upon which the reports are based.

equipment, Energy Commission staff recommends the use of ultra-low sulfur diesel fuel and Tier 2 or Tier 1 California Emission Standards for Off-Road Compression-Ignition Engines or the installation of an oxidation catalyst and soot filters on diesel equipment. The catalyzed diesel particulate filters are passive, self-regenerating filters that reduce particulate matter, carbon monoxide, and hydrocarbon emissions through catalytic oxidation and filtration. The degree of particulate matter reduction is comparable for both mitigation measures in the range of approximately 85–92%. Such filters will reduce diesel emissions during construction and reduce any potential for significant health impacts.

Proposed Project - Operation Impacts and Mitigation

Emissions Sources

The only stationary emissions source at the proposed Calico Solar Project would be one emergency diesel generator which would be operated once a month for about 20 minutes (4 hours per year). Mobile sources of TAC emissions during operations would include gasoline-fueled and diesel-fueled maintenance and delivery vehicles as well as visitor and staff traffic (Tessera Solar 2009q, Data Responses #109 and #111).

Public Health Table 2 lists the toxic emissions potentially emitted by the Calico Solar Project and shows how each contributes to the health risk analysis. Each TAC has a toxicity value with a Reference Exposure Level established by OEHHA, which is used to calculate short-term and long-term noncancer health effects, and cancer unit risk as published in the OEHHA Guidelines (OEHHA 2003).

Public Health Table 2
Types of Health Impacts and Exposure Routes Attributed to Toxic Emissions

Substance*	Oral Cancer	Oral Noncancer	Inhalation Cancer	Noncancer (Chronic)	Noncancer (Acute)
Acetaldehyde			✔	✔	
Acrolein				✔	✔
Benzene			✔	✔	✔
1,3-butadiene			✔	✔	
DPM			✔	✔	
Formaldehyde			✔	✔	✔

Source: OEHHA 2003, Appendix L and Tessera Solar 2009q, Table DR-111a.
*all substances come from the emergency diesel generator or from on-site maintenance vehicles

Emissions Levels

Once potential emissions are identified, the next step is to quantify them by conducting a “worst case” analysis. Maximum annual emissions are required to calculate cancer and chronic (long-term) noncancer health effects.

Table DR-111a of the Response to CEC and BLM Data Requests (Tessera Solar 2009q) provides the maximum hourly and annual emission rates for TACs from all sources during operations. Diesel particulate matter (DPM) emissions for the diesel emergency engine were calculated based on emission factors obtained from the vendor. DPM emissions from diesel-fueled delivery trucks were estimated using ARB's EMFAC2007 model. TACs from gasoline-fueled maintenance, staff, and visitor vehicles were estimated using EPA's MOBILE6.2 software.

The next step in the health risk assessment process is to estimate the ambient concentrations of toxic substances. This is accomplished by using a screening air dispersion model and assuming conditions that result in maximum impacts. The applicant's screening analysis was performed using the AERMOD model. Ambient concentrations were used in conjunction with Reference Exposure Levels and cancer unit risk factors to estimate health effects that might occur from exposure to facility emissions. Exposure pathways, or ways in which people might come into contact with toxic substances, include inhalation, dermal (through the skin) absorption, soil ingestion, consumption of locally grown plant foods, and mother's milk.

The above method of assessing health effects is consistent with OEHHA's Air Toxics Hot Spots Program Risk Assessment Guidelines (OEHHA, 2003) referred to earlier and results in the following health risk estimates.

Impacts

The applicant's screening health risk assessment for the project resulted in an acute Hazard Index (HI) of 0.062 and a chronic HI of 0.00000042 at the point of maximum impact (PMI). The worst-case individual cancer risk was calculated to be 0.000667 in 1 million at the PMI. All three PMIs were located on the boundaries of the project site or NAP areas (Tessera Solar 2009q, Table DR-111b). As **Public Health Table 3** shows, both the acute and chronic hazard indices and the maximum cancer risk are below the level of significance, indicating that no long-term or short-term cancer or non-cancer health effects are expected.

Public Health Table 3
Operation Hazard/Risk at Point of Maximum Impact: Applicant Assessment

Type of Hazard/Risk	Hazard Index/Risk	Significance Level	Significant?
Acute Noncancer	0.062	1.0	No
Chronic Noncancer	0.00000042	1.0	No
Individual Cancer	0.000667 in a million	10.0 in a million	No

Source: Tessera Solar 2009q, Table DR-111b

Staff conducted a quantitative evaluation of the risk assessment results presented in the Calico Solar Project AFC (08-AFC-13) and the document "In Response to CEC and BLM Data Requests, Set 1, Parts 1 and 2, Data Requests 1-48, 81, and 109-112," dated August 2009. Modeling files provided by the applicant were also reviewed. Staff concludes that, while standard procedures were followed in the applicant's analysis, two sources of uncertainty exist for which further clarification is necessary:

1. The difference in the number of vehicles to be used at the facility versus the number of vehicles modeled.
2. The use of average annual emission rates in the HARP modeling that are lower than the peak hourly rates.

In order to reduce public health impacts, several administrative changes were made to the original AFC. Of note is the proposal that, during construction, unpaved roads will be sealed, vehicle trip lengths will be reduced and the option of using alternatively fueled vehicles will be investigated. In order to reduce public health impacts during the operational phase of the project, the changes made include changing the diesel fire water pump to an electric unit, switching from diesel to gasoline vehicles for mirror wash and other maintenance vehicles, and switching to gasoline, electric and/or hybrid, vehicles for other vehicles used on-site. The remaining stationary emitting unit is the diesel-fueled emergency generator, for which the applicant is continuing to investigate the possibility of using gasoline or other alternative fuels. The emergency generator will be used 4 hours/year for testing purposes.

For the operations phase, atmospheric dispersion modeling of facility emissions was conducted by the applicant using AERMOD and the risk assessment was conducted using the CARB/OEHHA Hotspots Analysis and Reporting Program (HARP), Version 1.4a. The HARP On-Ramp program was used to load the AERMOD results into HARP. Local meteorological data were used and building downwash effects were included for 5 buildings. Potential risks to 5,211 grid receptors and 3 sensitive receptors were modeled. Exposure pathways assessed include inhalation, ingestion of home-grown produce, dermal absorption, soil ingestion and mother's milk. In staff's analysis of the HARP modeling files, the transaction file (.tra file) and the source receptor file (.src file) provided by the applicant were used.

Vehicle requirements for operations and maintenance are listed on page 144 of the August 2009 responses to data requests and include the following:

- 50 gasoline wash vehicles for cleaning solar reflector mirrors
- 28 gasoline LRU (line replacement unit) maintenance trucks
- 7 gasoline/hybrid staff and security trucks
- 120 staff cars, 5 vanpool vehicles, 10 visitor cars (all gasoline)
- 7 diesel delivery trucks

A total of 97 emitting units were modeled by the applicant for facility operations including:

- 1 diesel emergency generator
- 96 mobile sources involved in routine operations:
    - 39 wash and LRU vehicles
    - 7 security vehicles
    - 8 forklifts (fueled by propane)
    - 10 visitor vehicles
    - 25 staff vehicles
    - 7 diesel delivery trucks

It is not clear in the report why the number of vehicles modeled differs from the number of vehicles listed for the facility, leading to uncertainty as to whether all mobile sources were included in the modeling of emissions from facility operations.

Emission factors obtained from the August 2009 responses to data requests (Table DR-111a) are listed in **Public Health Table 4**. In staff's examination of the HARP modeling files provided by the applicant, it was noted that annual emissions values used are much lower than maximum 1-hour emissions values, as seen in **Public Health Table 5**. It is not possible, of course, for annual emissions to be lower than 1-hour emissions and this is contrary to the values reported in Table DR-111a, in which the annual emissions are much higher than the 1-hour emissions, as expected. This leads to the supposition that the average annual emission values used in the applicant's HARP modeling are mistaken.

Cancer risk and chronic hazard index values reported by the applicant in the August 2009 responses to data requests were very low, and verified through staff's model analysis conducted using the average annual emission values obtained from the HARP modeling files. For risk calculations using the HARP model, the "Derived (Adjusted) Method" was used for cancer risk and the "Derived (OEHHA) Method" was used for chronic noncancer hazard.

Staff conducted additional HARP modeling in which the 1-hour emissions reported in the HARP files for each mobile source were multiplied by a factor of 2,880 hours/year, which assumes operation of vehicles for 8 hours/day, 30 days/month for 12 months/year which is the rate at which the washing and LRU vehicles are expected to operate (source: page 144 of the August 2009 responses to data requests). For some vehicles this may be an underestimation (security vehicles are expected to run 24 hrs/day) or an overestimation (staff and vanpool vehicles are expected to run 2 hrs/day). The emission factors used in staff's HARP analysis are listed in **Public Health Table 6**. Cancer risk and chronic hazard index modeled by staff in this analysis are greater than those reported in the August 2009 responses to data requests, but still less than the significance levels of 10 in a million for cancer risk and 1.0 for hazard index. Staff cannot explain the difference other than to point out what appear to be mistakes in the applicant's analysis (above). The results of staff's operations phase risk assessment are compared to the results reported by the applicant in **Public Health Table 7**.

Staff's results for acute hazard index are lower than the results reported by the applicant due to a change in the acute REL for acrolein from the value used in the applicant's August 2009 report (0.19 ug/m^3) to the value published by OEHHA in their December 2008 guidance, 2.5 ug/m^3 (OEHHA 2008).

The point of maximum impact, PMI, was determined under the 70 year residential scenario. Three nearby residences, the only residential receptors located near the facility, were also modeled. Cumulative impacts were not evaluated as there are no existing or proposed projects within 6 miles of the facility.

Public Health Table 4
Operation Phase Emission Rates Listed in Response to Data Requests

Substance	Diesel Generator	Washing Vehicle (running & idling)	LRU Maintenance Truck (running & Idling)	Staff & visitor cars, van pool, security truck	Diesel Delivery Trucks	Total Emissions
Peak Hourly Emissions from <u>all</u> vehicles of each type (lb/hr)						
DPM	0.015				0.027	0.042
Benzene		0.024	0.014	0.036		0.074
1,3-Butadiene		0.002	0.001	0.002		0.005
Formaldehyde		0.010	0.006	0.005		0.022
Acetaldehyde		0.005	0.003	0.004		0.012
Acrolein		0.001	0.000	0.000		0.002
Annual Emissions from <u>all</u> vehicles of each type (lb/yr)						
DPM	0.18				13.40	13.58
Benzene		69.78	39.08	36.28		145.14
1,3-Butadiene		5.17	2.90	2.51		10.58
Formaldehyde		29.80	16.69	5.43		51.92
Acetaldehyde		13.45	7.53	4.27		25.25
Acrolein		2.29	1.28	0.30		3.87

Source: Response to Data Requests, August 2009, Table DR-111a
Note: Values listed are for emissions from <u>all</u> vehicles of each type
DPM = diesel particulate matter

Public Health Table 5
Operation Phase Emission Rates Used in Applicant's HARP Modeling

Substance	Diesel Generator	Washing Vehicle & LRU Maintenance Truck	Security	Visitor	Staff	Delivery Trucks
Peak Hourly Emissions <u>per</u> vehicle (lb/hr)						
DPM	0.015					3.91E-03
Benzene		9.69E-04	1.70E-04	6.52E-05	1.37E-03	
1,3-Butadiene		7.19E-05	1.21E-05	4.42E-06	9.38E-05	
Formaldehyde		4.14E-04	2.52E-05	9.80E-06	2.06E-04	
Acetaldehyde		1.87E-04	2.00E-05	7.67E-06	1.61E-04	
Acrolein		3.18E-05	1.37E-06	5.48E-07	1.15E-05	
Annual Emissions <u>per</u> vehicle (lb/yr)						
DPM	0.18					1.09E-07
Benzene		1.59E-07	8.37E-08	7.87E-09	7.87E-09	
1,3-Butadiene		1.18E-08	5.95E-09	5.33E-10	5.33E-10	
Formaldehyde		6.80E-08	1.24E-08	1.18E-09	1.18E-09	
Acetaldehyde		3.07E-08	9.84E-09	9.24E-10	9.24E-10	
Acrolein		5.23E-09	6.73E-10	6.60E-11	6.60E-11	

Source: Applicant's HARP modeling files
Note: Values listed are for emissions from ONE vehicle of each type
DPM = diesel particulate matter

Public Health Table 6
Operation Phase Emission Rates Used in Staff's HARP Modeling

Substance	Diesel Generator	Washing Vehicle & LRU Maintenance Truck	Security	Visitor	Staff	Delivery Trucks
Peak Hourly Emissions per vehicle (lb/hr)						
DPM	1.50E-02					3.91E-03
Benzene		9.69E-04	1.70E-04	6.52E-05	1.37E-03	
1,3-Butadiene		7.19E-05	1.21E-05	4.42E-06	9.38E-05	
Formaldehyde		4.14E-04	2.52E-05	9.80E-06	2.06E-04	
Acetaldehyde		1.87E-04	2.00E-05	7.67E-06	1.61E-04	
Acrolein		3.18E-05	1.37E-06	5.48E-07	1.15E-05	
Annual Emissions per vehicle (lb/yr)						
DPM	1.80E-01					1.13E+01
Benzene		2.79E+00	4.90E-01	1.88E-01	3.95E+00	
1,3-Butadiene		2.07E-01	3.48E-02	1.27E-02	2.70E-01	
Formaldehyde		1.19E+00	7.26E-02	2.82E-02	5.93E-01	
Acetaldehyde		5.39E-01	5.76E-02	2.21E-02	4.64E-01	
Acrolein		9.16E-02	3.95E-03	1.58E-03	3.31E-02	

Source: Peak hourly emissions from applicant's HARP modeling files; annual emissions are hourly emissions times 2,880 hrs/yr
Note: Values listed are for emissions from ONE vehicle of each type
DPM = diesel particulate matter

Public Health Table 7
Results of Staff's Analysis and the Applicant's Analysis for Cancer Risk and Chronic and Acute Hazard

	Staff's Analysis			Applicant's Analysis *(Source: Table DR-111b)*		
	Cancer Risk (per million)	Chronic HI	Acute HI	Cancer Risk (per million)	Chronic HI	Acute HI
PMI	2.7	0.0019	0.0083	0.000667	0.00000042	0.0616
MEIR (nearest resident receptor)	0.13	0.00011	0.0044	0.000014	0.000000009	0.0344

Notes:
PMI= point of maximum impact determined in staff's analysis; the PMI is located on the facility fenceline
MEIR = maximally exposed individual, residential is located at a residence approximately 0.3 miles south of the western area of the facility

Public Health Table 8
Results of Staff's Analysis: Contribution to Total Cancer Risk by Individual Substances from All Sources at the Point of Maximum Impact (PMI)

Substance	Diesel Emergency Generator	Mirror wash and LRU vehicles	Security Vehicles	Visitor Vehicles	Staff Vehicles	Diesel Delivery Vehicles	Total Risk
DPM	5.26E-11					2.17E-06	2.17E-06
Benzene		3.05E-09	4.47E-11	9.36E-11	3.66E-07		3.70E-07
1,3-Butadiene		1.36E-09	1.91E-11	3.79E-11	1.50E-07		1.52E-07
Formaldehyde		2.73E-10	1.39E-12	2.95E-12	1.15E-08		1.18E-08
Acetaldehyde		5.89E-11	5.26E-13	1.10E-12	4.30E-09		4.36E-09
Acrolein							
SUM	5.26E-11	4.74E-09	6.57E-11	1.36E-10	5.32E-07	2.17E-06	2.71E-06

Public Health Table 9
Results of Staff's Analysis: Contribution to Total Cancer Risk by Individual Substances from All Sources at the MEI-Resident

Substance	Diesel Emergency Generator	Mirror wash and LRU vehicles	Security Vehicles	Visitor Vehicles	Staff Vehicles	Diesel Delivery Vehicles	Total Risk
DPM	5.08E-12					8.66E-08	8.66E-08
Benzene		1.31E-09	2.82E-11	1.04E-09	2.98E-08		3.21E-08
1,3-Butadiene		5.82E-10	1.20E-11	4.21E-10	1.22E-08		1.32E-08
Formaldehyde		1.17E-10	8.77E-13	3.28E-11	9.39E-10		1.09E-09
Acetaldehyde		2.53E-11	3.31E-13	1.22E-11	3.50E-10		3.87E-10
Acrolein							
SUM	5.08E-12	2.03E-09	4.14E-11	1.51E-09	4.33E-08	8.66E-08	1.33E-07

C.6.5 REDUCED ACREAGE ALTERNATIVE

The Reduced Acreage alternative would essentially be a 275 MW solar facility located within the central portion of the proposed 850 MW project. It was developed because it could be constructed without the necessity of a new 500 kV transmission line, and would avoid several other environmental impacts. This alternative's boundaries and the revised locations of the transmission line, substation, laydown, and control facilities are shown in **Alternatives Figure 1**.

C.6.5.1 SETTING AND EXISTING CONDITIONS

The general setting and existing conditions would remain as described in C.15.4.1 although the land requirements would be proportionately reduced to reflect the smaller project size. Locations of laydown areas may also vary.

C.6.5.2 ASSESSMENT OF IMPACTS AND DISCUSSION OF MITIGATION

The Reduced Acreage Alternative is likely to result in reduced emissions which would decrease the cancer risk and chronic and acute hazard indices predicted for the 850 MW project as proposed. However, the public health analysis has determined that the cancer risk and chronic and acute hazard indices are far below the level of significance at the point of maximum impact for the project as proposed. Therefore staff concludes that with respect to public health impacts, the Reduced Acreage Alternative is not preferable over the project as proposed.

C.6.5.3 CEQA LEVEL OF SIGNIFICANCE

Similar to the proposed project, staff considers project compliance with LORS to be sufficient to ensure that no significant impacts to public health would occur as a result of emissions of TACs (HAPS) associated with the Reduced Acreage Alternative.

C.6.6 AVOIDANCE OF DONATED AND ACQUIRED LANDS ALTERNATIVE

The Avoidance of Donated and Acquired Lands Alternative would be an approximately 720 MW solar facility located within the boundaries of the proposed 850 MW project. This alternative, the transmission line, substation, laydown, and control facilities are shown in **Alternatives Figure 2**.

C.6.6.1 SETTING AND EXISTING CONDITIONS

The general setting and existing conditions would remain as described in C.15.4.1 although the land requirements would be proportionately reduced to reflect the smaller project size. Locations of laydown areas may also vary.

C.6.6.2 ASSESSMENT OF IMPACTS AND DISCUSSION OF MITIGATION

The 720 MW Alternative would result in similar types of public health and safety issues from construction, demolition and operation as the proposed 850 MW project. Staff has analyzed potential public health risks associated with construction and operation of the Calico Solar Project and does not expect any significant adverse cancer or long-term health effects to any members of the public, including low income and minority populations, from project toxic emissions. The Avoidance of Donated and Acquired Lands Alternative would reduce the project by approximately 15%, but otherwise represent the same impacts. Staff also concludes that its analysis of potential health impacts from the proposed Calico Solar Project uses a conservative health-protective methodology that accounts for impacts to the most sensitive individuals in a given population, including newborns and infants. According to the results of staff’s health risk assessment, emissions from Calico Solar Project would not contribute significantly or cumulatively to morbidity or mortality in any age or ethnic group residing in the project area.

C.6.6.3 CEQA LEVEL OF SIGNIFICANCE

Similar to the proposed project, staff considers project compliance with LORS to be sufficient to ensure that no significant impacts would occur to public health and safety associated with the construction or operation of the 720 MW Alternative.

C.6.7 NO PROJECT/NO ACTION ALTERNATIVE

There are three No Project / No Action Alternatives evaluated as follows:

No Project / No Action Alternative #1: No Action on the Calico Solar Project application and on CDCA land use plan amendment

Under this alternative, the proposed Calico Solar Project would not be approved by the CEC and BLM and BLM would not amend the CDCA Plan. As a result, no solar energy project would be constructed on the project site and BLM would continue to manage the site consistent with the existing land use designation in the CDCA Land Use Plan of 1980, as amended.

The results of the No Project / No Action Alternative would be the following:

- The impacts of the proposed project would not occur. However, the land on which the project is proposed would become available to other uses that are consistent with BLM's land use plan, including another renewable energy project.
- The benefits of the proposed project in displacing fossil fuel fired generation and reducing associated greenhouse gas emissions from gas-fired generation would not occur. Both State and Federal law support the increased use of renewable power generation.

If the proposed project is not approved, renewable projects would likely be developed on other sites in San Bernardino County, the Mojave Desert, or in adjacent states as developers strive to provide renewable power that complies with utility requirements and State/Federal mandates. For example, there are dozens of other wind and solar projects that have applications pending with BLM in the California Desert District. Under the No Project/No Action alternative public health impacts to the proposed project site and area would be similar as those currently occurring under the existing conditions in the area. Given that there would be no significant change over the existing conditions, the public health impacts of the No Project/No Action alternative would be less-than-significant.

No Project / No Action Alternative #2: No Action on the Calico Solar Project and amend the CDCA land use plan to make the area available for future solar development

Under this alternative, the proposed Calico Solar Project would not be approved by the CEC and BLM and BLM would amend the CDCA Land Use Plan of 1980, as amended, to allow for other solar projects on the site. As a result, it is possible that another solar energy project could be constructed on the project site.

Because the CDCA Plan would be amended, it is possible that the site would be developed with the same or a different solar technology. As a result, GHG emissions would result from the construction and operation of the solar technology and would likely be similar to the GHG emissions from the proposed project. Different solar technologies require different amounts of construction and operations maintenance; however, it is expected that all the technologies would provide the more significant benefit, like the proposed project, of displacing fossil fuel fired generation and reducing associated GHG emissions. As such, this No Project/No Action Alternative could result in GHG benefits similar to those of the proposed project.

No Project / No Action Alternative #3: No Action on the Calico Solar Project application and amend the CDCA land use plan to make the area unavailable for future solar development

Under this alternative, the proposed Calico Solar Project would not be approved by the CEC and BLM and the BLM would amend the CDCA Plan to make the proposed site unavailable for future solar development. As a result, no solar energy project would be constructed on the project site and BLM would continue to manage the site consistent with the existing land use designation in the CDCA Land Use Plan of 1980, as amended.

Because the CDCA Plan would be amended to make the area unavailable for future solar development, it is expected that the site would continue to remain in its existing condition, with no new structures or facilities constructed or operated on the site. As a result, the greenhouse gas emissions from the site, including carbon uptake, is not expected to change noticeably from existing conditions and, as such, this No Project/No Action Alternative would not result in the GHG benefits from the proposed project. However, in the absence of this project, other renewable energy projects may be constructed to meet State and Federal mandates, and those projects would have similar impacts in other locations.

C.6.8 PROJECT-RELATED FUTURE ACTIONS – PUBLIC HEALTH AND SAFETY

This section examines the potential impacts of future transmission line construction, line removal, substation expansion, and other upgrades that may be required by Southern California Edison Company (SCE) as a result of the Calico Solar Project. The SCE upgrades are a reasonably foreseeable event if the Calico Solar Project is approved and constructed as proposed.

The SCE project will be fully evaluated in a future EIR/EIS prepared by the BLM and the California Public Utilities Commission. Because no application has yet been submitted and the SCE project is still in the planning stages, the level of impact analysis presented is based on available information. The purpose of this analysis is to inform the Energy Commission and BLM, interested parties, and the general public of the potential environmental and public health effects that may result from other actions related to the Calico Solar Project.

The project components and construction activities associated with these future actions are described in detail in Section B.3 of this Staff Assessment/EIS. This analysis examines the construction and operational impacts of two upgrade scenarios

- The **275 MW Early Interconnection Option** would include upgrades to the existing SCE system that would result in 275 MW of additional latent system capacity. Under the 275 MW Early Interconnection option, Pisgah Substation would be expanded adjacent to the existing substation, one to two new 220 kV structures would be constructed to support the gen-tie from the Calico Solar Project into Pisgah Substation, and new telecommunication facilities would be installed within existing SCE ROWs.
- The **850 MW Full Build-Out Option** would include replacement of a 67-mile 220 kV SCE transmission line with a new 500 kV line, expansion of the Pisgah Substation at a new location and other telecommunication upgrades to allow for additional transmission system capacity to support the operation of the full Calico Solar Project.

C.6.8.1 ENVIRONMENTAL SETTING

The environmental setting described herein incorporates both the 275 MW Early Interconnection and the 850 MW Full Build-Out options. The setting for the 275 MW Early Interconnection upgrades at the Pisgah Substation and along the telecomm corridors is included within the larger setting for the project area under the 850 MW Full Build-Out option.

There are many potential public health concerns that could be associated with construction and operation of the SCE upgrades. These include health impacts due to the emissions of air pollutants; health risks from the emissions of air contaminants and airborne pathogens; exposure to hazards from the handling of wastes, chemicals and other materials; exposure to electromagnetic fields (EMF) from power transmission; and safety concerns for workers. EMF is discussed in the **TRANSMISSION LINE SAFETY AND NUISANCE** section of this Staff Assessment/EIS. Small quantities of hazardous or solid waste may be generated during the construction phase of the proposed upgrades, which is discussed under **HAZARDOUS MATERIALS MANAGEMENT** and **WASTE MANAGEMENT**. Worker safety is discussed in the **WORKER SAFETY AND FIRE PROTECTION** section of this Staff Assessment/EIS.

C.6.8.2 ENVIRONMENTAL IMPACTS

The potential for public exposure to hazardous materials is considered minimal because waste management plans would be implemented (see SA/EIS sections on **HAZARDOUS MATERIALS MANAGEMENT** and **WASTE MANAGEMENT**). Releases from the project in wastewater streams to the public sewer system are discussed in the section addressing **SOIL AND WATER RESOURCES**. Programs to create a safe workplace for project employees are described in **WORKER SAFETY**.

A public health issue that is not addressed elsewhere in this Staff Assessment/EIS would be health risks from the emissions of air contaminants during construction. The construction activities caused by the SCE upgrades would generate emissions at the locations of the work along the transmission line and telecommunication ROWs and at the Pisgah Substation site, as are discussed in the **AIR QUALITY** section of this Staff Assessment/EIS. The project would comply with federal, state, and local air quality rules and regulations. A State Implementation Plan was prepared for the Mohave Desert

Planning Area, which identifies sources of PM10 emissions and identifies control measures to reduce these emissions. Mitigation measures would be implemented to reduce the emissions generated during project construction and operation. Following implementation of mitigation discussed below, the construction of the SCE upgrades would not likely have a significant adverse impact on air quality in the area. Therefore, public exposure to air contaminants would not generate a significant public health risk.

C.6.8.3 MITIGATION

The Mojave Desert Air Quality Management District (MDAQMD) is responsible for the project area and developed the MDAQMD Ozone State Implementation Plan (SIP) (2004) for inclusion in the 2004 Southeast Desert Modified Ozone State Implementation Plan (2004 SED SIP). This plan identifies sources of PM10 emissions and mitigation measures to reduce these emissions. The upgrade projects would be required to comply with MDAQMD rules and portable equipment rules, which would dictate how the equipment could be operated. Mitigation measures would be implemented following the MDAQMD Ozone SIP to reduce the emissions generated during project construction and operation.

In addition, with effective and comprehensive control measures such as those listed in the **Air Quality** section of this Staff Assessment/EIS, as well as those recommended for the proposed Calico Solar Project, dust and equipment exhaust impacts could likely be reduced to a less than significant level and public exposure to air contaminants would not create a significant public health and safety risk.

C.6.8.4 CONCLUSION

The construction and structure removal activities associated with all of SCE's upgrades would cause emissions due to heavy-duty diesel and gasoline-powered construction equipment and fugitive particulate matter (dust) emissions from activity on unpaved surfaces. With effective and comprehensive control measures such as those recommended in the **AIR QUALITY** section of this SA/EIS for the proposed Calico Solar Project and included in Appendix EE of the AFC, dust and equipment exhaust impacts could likely be reduced to a less than significant level. As a result, public exposure to air contaminants would not be expected to generate a significant public health and safety risk.

C.6.9 CUMULATIVE IMPACTS AND MITIGATION

A project may result in a significant adverse cumulative impact where its effects are cumulatively considerable. "Cumulatively considerable" means that the incremental effects of an individual project are significant when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects (California Code Regulation, Title 14, section 15130). NEPA states that cumulative effects can result from individually minor but collectively significant actions taking place over a period of time" (40 CFR §1508.7).

C.6.9.1 GEOGRAPHIC EXTENT

Cumulative impacts can occur if implementation of the Calico Solar Project could combine with those of other local or regional projects. Cumulative impacts would occur locally if Calico Solar Project impacts combined with impacts of projects located within the same air basin. Cumulative impacts could also occur as a result of development of some of the many proposed solar and wind development projects that have been or are expected to be under consideration by the BLM and the Energy Commission in the near future. Many of these projects are located within the California Desert Conservation Area, as well as on BLM land in Nevada and Arizona.

For purposes of the cumulative analysis, the emissions from construction or operation of the Calico Solar Project could potentially combine with emissions from past, present and reasonably foreseeable projects to result in adverse health effects to the public. Cumulative impacts to public health could occur as a result of implementation of the Calico Solar Project on both a local and regional level. The geographic extent for the analysis of local cumulative impacts associated with the Calico Solar Project includes the Mojave Desert Air Basin (MDAB), which contains most of San Bernardino County and parts of Riverside County and Kern County.

C.6.9.2 CUMULATIVE IMPACT ANALYSIS

Cumulative impacts of the proposed project and other projects within a 6-mile radius were not evaluated by the applicant. The applicant has stated that there are no current or future projects within a 6-mile radius that could contribute to a public health cumulative impact, and therefore no further analysis was conducted (SES 2008a, Section 5.16.3). Nevertheless, there is a potential for substantial future development in the project area and throughout the southern California desert region, as indicated by the list of planed projects within a 10-mile radius (provided by the applicant), which includes several energy generating projects employing solar or wind technologies (SES 2008a, Table 5.18-3). Staff has analyzed the public health and safety effects of existing and foreseeable projects listed in the Cumulative Impacts section of the AFC (SES 2008a, Section 5.18) as follows.

C.6.9.3 LOCAL PROJECTS

The maximum cancer risk for emissions from the Calico Solar Project (calculated by staff) is 2.7 in one million at the point of maximum impact located at the project fenceline. The maximum impact location occurs where pollutant concentrations from the Calico Solar Project would theoretically be the highest. Even at this location, staff does not expect any significant change in lifetime risk to any person, and the increase does not represent any real contribution to the average lifetime cancer incidence rate due to all causes (environmental as well as life-style and genetic). Modeled facility-related residential risks are lower at more distant locations, and actual risks are expected to be much lower since worst-case estimates are based on conservative assumptions and thus overstate the true magnitude of the risk expected. Therefore, staff does not consider the incremental impact of the additional risk posed by the Calico Solar Project to be either individually or cumulatively significant.

C.6.9.4 REGIONAL PROJECTS

The nature of public health impacts from exposure to materials that could result in negative health effects combined with the vast area over which the future solar and wind development projects would be built in southeastern California, southern Nevada, and western Arizona, as well as the relative isolation of these projects from sensitive receptors, precludes the potential for impacts of these projects to combine with each other to result in significant impacts. Any emission from construction of these projects would be dispersed over these areas and would not be expected to result in chronic health problems to sensitive receptors. Operation of the future solar and wind energy projects would result in negligible emissions, mostly related to worker vehicles and maintenance trucks, therefore, operation of these future projects would not result in negative regional health effects.

C.6.9.5 CUMULATIVE IMPACT CONCLUSION

Public health impacts of the Calico Solar Project would not combine with impacts of any past, present, or reasonably foreseeable projects to result in cumulatively considerable local or regional impacts. Therefore, no mitigation is recommended to address potential cumulative project impacts.

C.6.10 COMPLIANCE WITH LORS

Staff has considered the minority population as identified in **Socioeconomics Figure 1** in its impact analysis and has found no potential significant adverse impacts for any receptors, including environmental justice populations. In arriving at this conclusion, staff notes that its analysis complies with all directives and guidelines from the Cal/EPA Office of Environmental Health Hazard Assessment and the California Air Resources Board. Staff's assessment is biased toward the protection of public health and takes into account the most sensitive individuals in the population. Using extremely conservative (health-protective) exposure and toxicity assumptions, staff's analysis demonstrates that members of the public potentially exposed to toxic air contaminant emissions of this project—including sensitive receptors such as the elderly, infants, and people with pre-existing medical conditions—will not experience any significant chronic or cancer health risk as a result of that exposure. Staff believes that it incorporated every conservative assumption called for by state and federal agencies responsible for establishing methods for analyzing public health impacts. The results of that analysis indicate that there would be no direct or cumulative significant public health and safety impact to any population in the area. Therefore, given the absence of any significant health impacts, there are no disparate health impacts and there are no environmental justice issues associated with **PUBLIC HEALTH AND SAFETY**.

Staff concludes that construction and operation of the Calico Solar Project will be in compliance with all applicable LORS regarding long-term and short-term project impacts in the area of **PUBLIC HEALTH AND SAFETY**.

C.6.11 NOTEWORTHY PUBLIC BENEFITS

It is noteworthy that a solar electric generating facility such as the proposed Calico Solar Project would emit significantly less TACs to the environment than other energy sources available in California such as natural gas or biomass, thereby reducing the health risks that would otherwise occur with these non-renewable energy sources. At the same time, the proposed Calico Solar Project would provide much needed electrical power to California residences and businesses, and will contribute to electric reliability. Electrical power is not only necessary to maintain a functioning society, but it also benefits many individuals who rely on powered equipment for their health (such as dialysis equipment and temperature control equipment). For example, it is documented that during heat waves in which elevated air-conditioning use causes an electrical blackout, hospitalizations and deaths due to heat stroke are increased.

C.6.12 FACILITY CLOSURE

Closure of the proposed Calico Solar Project (temporary or permanent) would follow a closure plan prepared by the applicant and designed to minimize public health and environmental impacts. Permanent closure would presumably occur 40 years after the start of operation unless the project remains economically viable. Decommissioning procedures would be consistent with all applicable LORS and would be submitted to the Energy Commission for approval before implementation (SES 2008a, Section 3.12.3). Staff expects that impacts to public health from the closure and decommissioning process would represent a fraction of the impacts associated with the construction or operation of the proposed Calico Solar Project.

Therefore based on staff’s analysis for the construction and operation phases of this project, staff concludes that public health-related impacts from closure and decommissioning of the Calico Solar Project would be insignificant.

C.6.13 PROPOSED CONDITIONS OF CERTIFICATION/MITIGATION MEASURES

No conditions of certification or mitigation measures are proposed.

C.6.14 CONCLUSIONS

Staff has analyzed potential public health risks associated with construction and operation of the Calico Solar Project and does not expect any significant adverse cancer or long-term health effects to any members of the public, including low income and minority populations, from project toxic emissions. Staff also concludes that its analysis of potential health impacts from the proposed Calico Solar Project uses a conservative health-protective methodology that accounts for impacts to the most sensitive individuals in a given population, including newborns and infants. According to the results of staff’s health risk assessment, emissions from Calico Solar Project would not contribute significantly or cumulatively to morbidity or mortality in any age or ethnic group residing in the project area.

C.6.15 REFERENCES

BAAQMD (Bay Area Air Quality Management District). 2004b. Toxic Air Contaminant Control Program Annual Report 2002. Volume I. June.

California Air Resources Board (CARB) 2002. California Air Quality Data, <http://www.arb.ca.gov/aqd/aqd.htm>.

California Air Resources Board (CARB) 2009. Annual Toxics Summaries. http://www.arb.ca.gov/adam/toxics/toxics.html

CAPCOA (California Air Pollution Control Officers Association).1993. CAPCOA Air Toxics “Hot Spots” Program Revised 1992 Risk Assessment Guidelines. Prepared by the Toxics Committee. October.

OEHHA (Office of Environmental Health Hazard Assessment). 2003. *Air Toxics Hot Spots Program Risk Assessment Guidelines*. The Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments. August.

Office of Environmental Health Hazard Assessment (OEHHA). 2008. “All OEHHA Acute, 8-hour and chronic Reference Exposure Levels (chRELS) as on December 18, 2008.” http://www.oehha.ca.gov/air/allrels.html

SES (Stirling Energy Systems Solar Three and Solar Six, LLC) 2008a (tn: 49181) – Application for Certification for the Stirling Energy Systems (SES) Solar One Project, Volumes 1 and 2. Submitted to the California Energy Commission, December 1, 2008.

Tessera Solar 2009q – Applicant's Responses to CEC and BLM Data Requests 1-48, 81, and 109-112 Set 1 Parts 1 and 2, August 31, 2009.

SRP (Scientific Review Panel on Toxic Air Contaminants). 1998. Findings of the Scientific Review Panel on The Report on Diesel Exhaust as adopted at the Panel’s April 22, 1998, meeting.

C.7 – HYDROLOGY, WATER USE AND WATER QUALITY (SOIL AND WATER RESOURCES)

Testimony of Casey Weaver

C.7.1 SUMMARY OF CONCLUSIONS

With the information provided to date, the U.S. Bureau of Land Management and California Energy Commission staff (hereafter jointly referred to as staff) have determined that construction, operation, and decommissioning of the proposed Calico Solar Project (formerly the Stirling Energy Systems Solar One Project) could potentially impact soil and water resources. Where these potential impacts have been identified, staff has proposed mitigation measures to reduce identified impacts to levels that are less than significant. The mitigation measures, as well as specifications for laws, ordinances, regulations and standards conformance, are included herein as conditions of certification. The conditions of certification referred to herein address the California Environmental Quality Act requirements for the California Energy Commission's analysis and the Bureau of Land Management's needs for a National Environmental Policy Act analysis. The Project would conform to all applicable laws, ordinances, regulations and standards (LORS). Staff's conclusions based on analysis of the information submitted to-date are as follows:

1. The proposed project would be located in the Mojave Desert of San Bernardino County in an area characterized by braided stream channels, flash flooding, alluvial fan conditions, low rainfall, sparse vegetation, and the potential for wind erosion/ deposition.
2. The project proposes to place 34,000 solar dishes, known as SunCatchers, within areas known to be subject to flash flooding and erosion. Project-related changes to the braided and alluvial fan stream hydraulic conditions could result in on-site erosion, stream bed degradation or aggradation, and erosion and sediment deposition impacts to adjacent land. SunCatchers within the stream courses could be subject to destabilization by stream scour. Impacts to soils related to wind erosion and runoff-borne erosion are potentially significant, as are impacts to surface water quality from sedimentation and the introduction of foreign materials, including potential contaminants, to the project area.
3. The applicant completed a hydrologic study and hydraulic modeling of the major stream channels on the project. Based on this work and subsequent analysis by staff, the project can be designed to withstand flash flood flows with minimal damage to SunCatchers. Condition of Certification **SOIL&WATER-3** ensures such a design.
4. A Draft Drainage, Erosion, and Sedimentation Control Plan mitigates the potential project-related storm water and sediment impacts. However, the calculations and assumptions used to evaluate potential storm water and sedimentation impacts are imprecise and have limitations and uncertainties associated with them such that the magnitude of potential impacts that could occur cannot be determined precisely. Based on these factors, the proposed project could result in impacts that would be significant with respect to California Environmental Quality Act significance criteria specified herein and National Environmental Policy Act significance criteria specified in 40 CFR 1508.27. Therefore, Conditions of Certification **SOIL&WATER-1,**

SOIL&WATER-2 and **SOIL&WATER-3** have been developed that define specific methods of design analysis, development of best management practices, and monitoring and reporting procedures to mitigate impacts related to flooding, erosion, sedimentation, and stream morphological changes. Compliance with LORS, particularly the Clean Water Act requirements, will insure no adverse impacts to waters of the U.S. With implementation of these Conditions, the potential effects of the proposed project would be less than significant. The applicant has not provided information necessary to complete development of requirements for dredge and fill in waters of the state. Once the applicant provides this information staff can complete development of requirements that will be included in Condition of Certification **SOIL&WATER-2.**

5. Surface water and groundwater quality could be affected by construction activities, ongoing activities on the project site including mirror washing, vehicle use and fueling, storage of oils and chemicals, the proposed septic and leach field system for sanitary wastes, and wastes from the water treatment system. These impacts are potentially significant. Compliance with laws, ordinances, regulations and standards and Conditions of Certification **SOIL&WATER-1, SOIL&WATER-2, SOIL&WATER-3** and **SOIL&WATER-6** will mitigate to a level less than significant. The applicant has not provided information necessary to complete development of requirements for discharges of brine waters to evaporation ponds or sanitary septic systems. Once the applicant provides this information staff can complete development of requirements that will be included in Condition of Certification **SOIL&WATER-2.**
6. Impacts to groundwater supply and groundwater quality during construction and operations would be less than significant. SunCatcher mirrors will be spray washed on a regular basis. Mirror washing and dust control watering will comprise the primary water uses for the project. Daily maximum water use is estimated to be 43.7gallons per minute (gpm) during construction, with total annual use of approximately 20 AF for operation. Conditions of Certification **SOIL&WATER-2**, **SOIL&WATER-3**, and **SOIL&WATER-4** are proposed by staff to ensure this water supply and treatment system comply with laws, ordinances, regulations and standards and not pose adverse impacts to water quality or supply. The applicant has not provided information necessary to complete development of requirements for discharges of brine waters to evaporation ponds or sanitary septic systems. Once the applicant provides this information staff can complete development of requirements that will be included in Condition of Certification **SOIL&WATER-2**.
7. The proposed project would use air-cooled radiators fitted on each individual engine for heat rejection. Use of this technology would substantially reduce potential water use and is consistent with Energy Commission water policy.

C.7.2 INTRODUCTION

This section analyzes potential impacts to soil and water resources from the construction and operation of the proposed Calico Solar Project. The analysis specifically focuses on the potential for Calico Solar to:

- cause accelerated wind or water erosion or sedimentation;
- exacerbate flood conditions in the vicinity of the project;

- adversely affect surface or groundwater supplies;
- degrade surface or groundwater quality; and,
- comply with all applicable laws, ordinances, regulations, and standards (LORS) and state policies.

Where the potential for significant adverse impacts is identified, staff has proposed mitigation measures to reduce the significance of the impacts, if possible, and has recommended conditions of certification.

C.7.3 METHODOLOGY AND THRESHOLDS FOR DETERMINING ENVIRONMENTAL CONSEQUENCES

The most significant potential impacts due to project development are typically those leading to soil erosion, flooding, or depletion or degradation of water resources. Thresholds for determining significance in this document are based on Appendix G of the California Environmental Quality Act (CEQA) Guidelines (CCR 2006) and performance standards or thresholds identified by the Energy Commission staff. In addition, staff's evaluation of the significance of the impact of the proposed project on soils, hydrology, water use and water quality (i.e., those listed below) includes an assessment of the context and intensity of the impacts, as defined in the National Environmental Policy Act (NEPA) implementing regulations 40 CFR Part 1508.27. The significance thresholds for soil and water resources are discussed in Section C.7.5.1.3.

Soils, hydrology and water resources impacts would be considered significant if the proposed project results in the effects listed below.

- violates any water quality standards or waste discharge requirements.
- substantially depletes groundwater supplies or interferes substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted).
- substantially alters the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation onsite/offsite.
- substantially alters the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding onsite/offsite,
- creates or contributes runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff.
- otherwise substantially degrades surface water or groundwater quality
- places structures within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map

- exposes people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam.

Staff believes that soil erosion and flooding impacts, which are described below, are the most potentially significant impacts associated with the proposed project.

- The project will cause erosion of the project site and deposition of sediment into waters of the State. Portions of the site will largely be barren soil when constructed. Barren soil is subject to erosion by wind and water. Application of soil stabilizers and adherence to best management practices (BMPs) would reduce surface soil erosion and sedimentation impacts to less than significant.
- There could be flooding of the project site, as designed and constructed, and redirection of flood flows. Foundation elements (driven poles) designed to support the SunCatchers are proposed to be installed within existing drainage channels. The volume of the foundation elements will decrease the capacity of the existing channel to contain flood flows. Adherence to the Conditions of Certification regarding the construction and maintenance of the foundation elements within the active channels will reduce the potential impacts to less than significant.

LAWS, ORDINANCES, REGULATIONS, AND STANDARDS

The following federal, state, and local environmental LORS are applicable to the Calico Solar Project and are designed to ensure the best and appropriate use and management of both soil and water resources. Additionally, the requirements of these LORS are specifically intended to protect human health and the environment. The project's compliance with these LORS, as required by staff's recommended conditions of certification, is a major component of staff's determination regarding the significance and acceptability of the Calico Solar Project with respect to the use and management of soil and water resources.

Soil & Water Table 1
Laws, Ordinances, Regulations, and Standards

Federal LORS	
Clean Water Act (33 U.S.C. Section 1257 et seq.)	The Clean Water Act (CWA) (33 USC § 1257 et seq.) requires states to set standards to protect water quality, which includes regulation of storm water and wastewater discharges during construction and operation of a facility. California established its regulations to comply with the CWA under the Porter-Cologne Water Quality Control Act of 1967. The CWA also establishes protection of navigable waters through Section 401 and 404. Section 404 permitting and. Section 401 certification through the Army Corps of Engineers and Regional Water Quality Control Board (RWQCB) is required if there are potential impacts to surface waters of the State and/or Waters of the United States, such as perennial and ephemeral drainages, streams, washes, ponds, pools, and wetlands. The Army Corps and RWQCB can require impacts to these waters to be quantified and mitigated.

Resource Conservation and Recovery Act, 40 CFR Part 260 et seq.	The Resource Conservation Recovery Act (RCRA) is a comprehensive body of regulations that give U.S. EPA the authority to control hazardous waste from the "cradle-to-grave." This includes the generation, transportation, treatment, storage, and disposal of hazardous waste. RCRA also sets forth a framework for the management of non-hazardous solid wastes.
State LORS	
California Constitution, Article X, Section 2	This section requires that the water resources of the State be put to beneficial use to the fullest extent possible and states that the waste, unreasonable use or unreasonable method of use of water is prohibited.
The Porter-Cologne Water Quality Control Act of 1967, Water Code Sec 13000 et seq.	Requires the State Water Resources Control Board (SWRCB) and the nine RWQCBs to adopt water quality criteria to protect state waters. Those regulations require that the RWQCBs issue Waste Discharge Requirements specifying conditions for protection of water quality as applicable. Section 13000 also states that the State must be prepared to exercise its full power and jurisdiction to protect the quality of the waters of the State from degradation.
California Water Code Section 13050	Defines "waters of the State."
California Water Code Section 13240, 13241, 13242, 13243, & Water Quality Control Plan for the Lahontan Region (Basin Plan)	The Basin Plan establishes water quality objectives that protect the beneficial uses of surface water and groundwater in the Region. The Basin Plan describes implementation plans and other control measures designed to ensure compliance with statewide plans and policies and provides comprehensive water quality planning. The following chapters are applicable to determining appropriate control measures and cleanup levels to protect beneficial uses and to meet the water quality objectives: Chapter 2, Present and Potential Beneficial Uses; Chapter 3, Water Quality Objectives, and the sections of Chapter 4, Implementation, entitled "Requirements for Site Investigation and Remediation," "Cleanup Levels," "Risk Assessment," "Stormwater Problems and Control Measures," Erosion and Sedimentation," "Solid and Liquid Waste Disposal to Land," and "Groundwater Protection and Management."
California Water Code Section 13260	Requires filing, with the appropriate RWQCB, a report of waste discharge that could affect the water quality of the state unless the requirement is waived pursuant to Water Code section 13269.
California Code of Regulations, Title 23, Division 3, Chapter 30	This chapter requires the submission of analytical test results and other monitoring information electronically over the internet to the SWRCB's Geotracker database.
State Water Resources Control Board General Permit CAS000002.	The SWRCB regulates storm water discharges associated with construction projects affecting areas greater than or equal to 1 acre to protect state waters. Under General Permit CAS000002, the SWRCB has issued a National Pollutant Discharge Elimination System (NPDES) General Permit for storm water discharges associated with construction activity. Projects can qualify under this permit if specific criteria are met and an acceptable Storm Water Pollution Prevention Plan (SWPPP) is prepared and implemented after notifying the SWRCB with a Notice of Intent.
State Water Resources Control Board 2003-003-DWQ	This general permit applies to the discharge of water to land that has a low threat to water quality. Categories of low threat discharges include piping hydrostatic test water.

California Code of Regulations, Title 22	Title 22, Division 4, Chapter 15 specifies Primary and Secondary Drinking Water Standards in terms of Maximum Contaminant Levels (MCLs). These MCLs include total dissolved solids (TDS) ranging from a recommended level of 500 milligrams per liter (mg/l), an upper level of 1,000 mg/l and a short term level of 1,500 mg/l. Other water quality MCLs are also specified, in addition to MCLS specified for heavy metals and chemical compounds.
California Code of Regulations, Title 23	Title 23, Division 3, Chapter 15 applies to waste discharges to land and requires the Regional Board issue Waste Discharge Requirements specifying conditions for protection of water quality as applicable.
Local LORS	
County of San Bernardino General Plan and Development Code	Grading in San Bernardino County is subject to terms and conditions of San Bernardino County's General Plan, Development Code and California Building Code, based upon the 2006 International Building Code. Although the proposed site is located on federal land, county regulations for public health and safety are considered to be applicable to the project. If a county grading permit is required, the grading plan would need to be completed in compliance with San Bernardino County's General Plan and Development Code.
California Safe Drinking Water Act and San Bernardino County Code Title 3, Division 3, Chapter 6, Public Water Supply Systems	Requires public water systems to obtain a Domestic Water Supply Permit. The California Safe Drinking Water Act requires public water systems to obtain a Domestic Water Supply Permit. Public water systems are defined as a system for the provision of water for human consumption through pipes or other constructed conveyances that has 15 or more service connections or regularly serves at least 25 individuals daily at least 60 days out the year. California Department of Public Health (CDPH) administers the Domestic Water Supply Permit program, and has delegated issuance of Domestic Water Supply Permits for smaller public water systems in San Bernardino County to the County. Under the San Bernardino County Code Title 3, 5.15-6 Division 3, Chapter 6, Public Water Supply Systems, the County Department of Environmental Services monitors and enforces all applicable laws and orders for public water systems with less than 200 service connections. The proposed project would likely be considered a non-transient, non-community water system.
San Bernardino County Title 3, Division 3, Chapter 6,Article 5, Desert Groundwater Management	To help protect water resources in unregulated portions of the desert while not precluding its use, the County adopted this article. This article requires a permit to locate, construct, operate, or maintain a new groundwater well within the unincorporated, unadjudicated desert region of San Bernardino County. California Environmental Quality Act (CEQA) compliance must be completed prior to issuance of a permit, and groundwater management, mitigation, and monitoring may be required as a condition of the permit. The ordinance states that it does not apply to "groundwater wells located on Federal lands unless otherwise specified by inter-agency agreement." The BLM and County entered into a Memorandum of understanding (MOU) that provides that the BLM will require conformance with this code for all projects proposing to use groundwater from beneath public lands.
San Bernardino County Development Code Section 82.13.080, Soil Erosion and Sediment Control Plans/Permits	Section 82.13.080 establishes regulations and procedures to control human existing and potential induced accelerated erosion. Elements of this ordinance include project planning, preparation of Soil Erosion and Sediment Control Plans, runoff control, land clearing, and winter operations.
San Bernardino County Municipal Stormwater Permit	The current Permit, Order No. R8-2010-0036 adopted January 29, 2010,, outlines a schedule of monitoring requirements, best management practices, and conditions designed to promote the reduction of pollutants in stormwater discharges.

San Bernardino County Ordinance Code, Title 3, Division 3, Chapter 8, Waste Management, Article 5, Liquid Waste Disposal	This ordinance requires the following compliance for all liquid waste disposal systems: (1) compliance with applicable portions of the Uniform Plumbing Code and the San Bernardino County Department of Environmental Health (DEHS) standards; (2) approval by the DEHS and building authority with jurisdiction over the system; or (3) for alternative systems, approval by the DEHS, the appropriate building official of this jurisdiction, and the appropriate California RWQCB.
San Bernardino County Ordinance Code, Title 6, Division 3, Chapter 3, Uniform Plumbing Code	This ordinance describes the installation and inspection requirements for locating disposal/leach fields and seepage pits.
State Policies and Guidance	
Integrated Energy Policy Report (Public Resources Code, Div. 15, Section 25300 et seq.)	In the 2003 Integrated Energy Policy Report (IEPR), consistent with SWRCB Policy 75-58 and the Warren-Alquist Act, the Energy Commission adopted a policy stating they will approve the use of fresh water for cooling purposes by power plants only where alternative water supply sources and alternative cooling technologies are shown to be “environmentally undesirable” or “economically unsound.”
State Water Resources Control Board Res. No. 68-16	The “Antidegradation Policy” mandates that: 1) existing high quality waters of the State are maintained until it is demonstrated that any change in quality will be consistent with maximum benefit to the people of the State, will not unreasonable affect present and anticipated beneficial uses, and will not result in waste quality less than adopted policies; and 2) requires that any activity which produces or may produce a waste or increased volume or concentration of waste and which discharges or proposes to discharge to existing high quality waters, must meet waste discharge requirements which will result in the best practicable treatment or control of the discharge necessary to assure that: a) a pollution or nuisance will not occur and b) the highest water quality consistent with maximum benefit to the people of the State will be maintained.
State Water Resources Control Board Res. 75-58	The principal policy of the SWRCB that addresses the specific siting of energy facilities is the Water Quality Control Policy on the Use and Disposal of Inland Waters Used for Power Plant Cooling (adopted by the Board on June 19, 1976, by Resolution 75-58). This policy states that use of fresh inland waters should only be used for power plant cooling if other sources or other methods of cooling would be environmentally undesirable or economically unsound.
State Water Resources Control Board Res. No. 88-63	States that all groundwater and surface water of the State are considered to be suitable for municipal or domestic water supply with the exception of those waters that meet specified conditions.
State Water Resources Control Board Res. 2005-0006	Adopts the concept of sustainability as a core value for State Water Board programs and directs its incorporation in all future policies, guidelines, and regulatory actions.
State Water Resources Control Board Res. 2008-0030	Requires sustainable water resources management such as low impact development (LID) and climate change considerations, in all future policies, guidelines, and regulatory actions. Directs Regional Water Boards to “aggressively promote measures such as recycled water, conservation and LID Best Management Practices where appropriate and work with Dischargers to ensure proposed compliance documents include appropriate, sustainable water management strategies.”
The California Safe Drinking Water and Toxic Enforcement Act	The California Health & Safety Code Section 25249.5 et seq. prohibits actions contaminating drinking water with chemicals known to cause cancer or possessing reproductive toxicity. The RWQCB administers the requirements of the Act.

C.7.4 PROPOSED PROJECT

C.7.4.1 SETTING AND EXISTING CONDITIONS

Proposed Project

The proposed Calico Solar Project site is approximately 8,230 acres of undeveloped land located within the Mojave Desert in the central portion of San Bernardino County. The site is located approximately 37 miles east of Barstow, California with its southern boundary adjacent to Interstate 40 (I-40) (**Soil and Water Figure 1**). Main access to the project is via north-bound Hector Road, which exits I-40, enters the southern project boundary near the center line of the project and travels north for approximately 1 mile, where it crosses the Burlington North Santa Fe (BNSF) railroad. Secondary access to the project is attained adjacent to the Pisgah substation. Access to the Pisgah substation begins on I-40 at the southbound Hector Road off ramp. Southbound Hector Road ends abruptly at the intersection with old Route 66. Taking east-bound Rte 66 approximately 4 3/4 miles, the road turns north, passes beneath I-40 and turns west for approximately 1 mile ending at a northeast heading dirt road that leads to the Pisgah substation, approximately ¼ mile northeast of that intersection.

Site construction will be accomplished in two phases and will include the development of four laydown areas, two for each of the two construction phases (**Soil and Water Figure 4**). For Phase I, one laydown area will be a 26-acre site to be located in the south east corner of the Phase I boundary adjacent to the eastern project entrance just north of the Pisgah Substation. The other Phase 1 laydown area will be a 14- acre site located adjacent to the Main Services Complex, provisionally identified to be constructed in the central portion of the project site. Phase 2 construction will utilize a 26- acre site located adjacent to the I-40 Hector Road off ramp. Another laydown area is an 11- acre site to be constructed south of the BNSF railroad and north of I-40. Temporary site access for Phase 1 construction needs would be constructed off I-40 beginning east of the Pisgah Substation and would traverse approximately 3.5 miles across Pisgah Area of Critical Environmental Concern (ACEC) requiring an approximately 30-foot Right of Way (ROW). Long term permanent access would be would be accomplished by building a bridge over the BNSF railroad along Hector Road north of I-40. In addition to the proposed Calico Solar site and construction areas, there are other features and facilities associated with the proposed project (the majority of which are located on the proposed project site or construction laydown area), including:

- Approximately 34,000 38-foot diameter solar dish Stirling systems and associated equipment and infrastructure within a fenced boundary;
- An onsite, 14.4-acre Main Services Complex that would be located generally in the center of the site for administration and maintenance activities. The complex would include three SunCatcher assembly buildings, administrative offices, operations control room, maintenance facilities, parking and access roads and a water treatment complex that would include a water treatment structure, raw water storage tank, demineralized water storage tank, basins and a potable water tank;
- An onsite hydrogen generation system;

- An onsite, 3-acre, 850-MW Substation that would deliver the generated electrical power to the existing Pisgah Substation, located generally in the south east corner of the site;
- Twelve to fifteen electrical transmission towers approximately 100 feet high that would be constructed to convey the electricity from the onsite substation to the Pisgah substation;
- Approximately 50 miles of underground 34.5kV cable;
- Approximately 650 miles of 600V cable;
- Approximately 500 miles of paved and unpaved roads;
- Underground water pipeline; and,
- Underground hydrogen supply pipelines.

In addition to the onsite features discussed above, an existing offsite water supply well (located in Cadiz, CA) is proposed to supply water for the project. This water would be transported to the project site by train.

Project, Site, and Vicinity Setting

The proposed project site is located in the central portion of San Bernardino County. The surrounding area consists of undeveloped desert land with small rural communities in the vicinity. The City of Barstow is located approximately 37 miles northwest of the project, the ghost town of Calico is located approximately 25 miles northwest of the project, the town of Bagdad is located approximately 36 miles southeast of the project and the town of Amboy is located approximately 42 miles southeast of the project.

Climate

The Calico Solar Project site is located in the Mojave Desert in southeastern California. The area is classified as a high desert climate characterized by low precipitation, hot summers, mild to cold winters, low humidity and strong temperature inversions. It is separated from the coastal regions by the San Gabriel and San Bernardino mountain ranges to the south and the Tehachapi Mountains to the west. The area's climatic conditions are strongly influenced by the large scale sinking and warming of air in the semi-permanent subtropical high pressure center over the eastern Pacific Ocean. This sinking air coupled with the site's distance from the ocean and its location in the rain shadow of surrounding mountains severely limits precipitation in the site vicinity.

Temperature and precipitation have been measured at Barstow Daggett Airport since 1948. These data indicate that the hottest month is July with the highest mean annual temperature of 104.2 degrees Fahrenheit (ºF) and lowest mean annual temperature of 73.2 ºF. The coldest month is January with the highest mean annual temperature of 60.6 ºF and lowest mean annual temperature of 35.9 ºF.

Most of the area's precipitation occurs during the winter season, which is largely responsible for the average precipitation of approximately 4 inches. During summer months, rain is scarce, and relative humidity is very low.

The area is often windy, typical of a desert environment. The prevailing wind is from the west or west-southwest, and is generally stronger during summer than winter.

Groundwater

Lavic Valley

The project site lies within the Lavic Valley Groundwater Basin. The basin is approximately 159 square miles in area and is bounded by nonwater-bearing rocks of the Cady Mountains on the north and east, of the Bullion Mountains on the south and east, of the Lava Bed Mountains on the southwest, and by the Pisgah fault on the west. Parts of the eastern and northern boundaries are drainage divides. The southern part of this basin lies within the Twentynine Palms Marine Corps Base. In the northern part of the basin, surface drainage is toward Hector Siding and in the southern part of the basin, surface drainage is toward Lavic (dry) Lake (DWR 2004; Rogers 1967). Groundwater may flow eastward out of the basin beneath a surface drainage divide. Groundwater in the basin is found in Quaternary alluvial and lacustrine deposits. Holocene age alluvium consists of unconsolidated, well-sorted, fine- to coarse-grained sand, pebbles, and boulders with variable amounts of silt and clay deposited in washes and alluvial fans (DWR 1967). Pleistocene age deposits are composed of gently tilted, unconsolidated to moderately consolidated, moderately well bedded gravel, sand, silt and clay (DWR 1967). The principal basin recharge is derived from percolation of runoff from surrounding mountains through alluvial fans and washes (DWR 1967). Subsurface flow from adjoining basins may also contribute to recharge (DWR 1967).

Water from a well in the southern part of the basin near Lavic Lake sampled in 1917 was sodium sulfate in character with a TDS content of 1,680mg/L (DWR 1967; DWR 1954). Water from a well in the northeastern part of the basin sampled in the 1950s was sodium sulfate in character with a TDS content of 1,721mg/L. Water from a well in the northwestern part of the basin near Hector Siding sampled in the 1950s was calcium-sodium bicarbonate in character with a TDS content of 278mg/L.

Cadiz Valley

The applicant proposes to use groundwater for project construction and operation obtained from a well located in Cadiz, California. Cadiz is located approximately 64 miles southeast of the proposed project site within the Cadiz Valley groundwater basin of the Colorado River Hydrologic Region. Structurally, the Bristol and Cadiz groundwater basins constitute a single physiographic unit (Thompson 1929). A low alluvial divide separates the unit into two parts; the northwest division which holds Bristol Dry Lake (Bristol Valley Groundwater Basin) and a southeastern division which holds Cadiz Dry Lake (Cadiz Valley Groundwater Basin). The Bristol and Cadiz Valleys occupy a single great valley or trough that trends in a northwesterly direction. Thompson considered that the name Bristol Trough describes the large trough that contains Bristol and Cadiz Valleys and he stated that the two divisions clearly form a single major unit and therefore he considered the trough as one unit. The southwestern border of the trough is formed by the Bullion, Sheep Hole, and Coxcomb Mountains, which extend almost continuously from the northwest to the southeast ends of the basin. The northeastern border of the trough is more irregular with relatively isolated northwesterly trending ridges. These ridges are the Bristol and Old Dad Mountains.

Large drainages flow through the gaps between the ridges. The Bristol Trough is separated from Fenner Valley (located northeast) by the Marble and Ship Mountains. A wash which passes between these mountains brings the drainage from the Fenner and Lanfair Valleys into the Bristol Trough. Southeast of the Ship Mountains, the eastern portion of the Bristol Trough is formed by the Old Woman Mountains and Kilbeck Hills.

The maximum thickness of sediments in the Bristol trough is unknown, but may be greater than 6,000 feet in the vicinity of Bristol Dry Lake (Maas 1994). Based on available geologic, hydrologic, and geophysical data, the principal formations in the Cadiz Valley that can store and transmit groundwater have been divided into three general units: an upper alluvial aquifer; a lower alluvial aquifer; and a bedrock aquifer. The upper aquifer consists of Quaternary and late-Tertiary alluvial sediments, including stream deposited sand and gravel with lesser amounts of silt (Moyle 1967; Metropolitan 1999b). The thickness of the upper alluvial sediments is approximately 100 to 800 feet (Metropolitan 1999b). The lower alluvial aquifer consists of older sediments, including interbedded sand, gravel, silt, and clay of mid- to late-Tertiary age. Where these materials extend below the water table, they yield water freely to wells but are generally less permeable than the upper aquifer sediments (Moyle 1967; Metropolitan 1999b).

Prior to 1929, eight wells were drilled in the Bristol valley by the Atchison, Topeka & Santa Fe Railway. Of those 8, two produced very little water. The other six produced abundant water but it was too salty to be used. While the initial wells indicated that the majority of the basin contained mostly salty water, fresh water was found in wells drilled at Cadiz, Archer and southwest of Altura. Thompson attributed this anomalously high quality groundwater found in Cadiz as originating in Fenner Valley and flowing through the subsurface between Ship and Marble Mountains. The Fenner Valley watershed includes all of Fenner Valley and a portion of Lanfair Valley (see Figure 5). The boundaries of this watershed are defined by the Marble and Providence mountains to the west, the New York and Providence mountains to the north, the Piute Range to the northeast, and the Old Woman and Ship mountains to the east. The Clipper Mountains, which reach elevations above 4,600 feet, occur entirely within the Fenner Valley watershed. Elevations within the watershed range from a high of more than 7,500 feet in the New York Mountains to a low of approximately 900 feet in Fenner Gap. Fenner Gap, which forms the surface and groundwater drainage outlet of the Fenner Valley watershed, is located between the Marble and Ship mountains. Similarly, Thompson (1929), concluded that the high quality water found at Archer had originated in the Old Woman Mountains and flowed in the subsurface toward Cadiz Dry Lake.

A production well located in Fenner Gap draws water primarily from the upper and lower aquifers and yields 3,000 gallons per minute with less than 20 feet of drawdown (Metropolitan 1999b). The Cadiz Inc. agricultural wells draw water from the alluvial aquifers and typically yield 1,000 to more than 2,000 gallons per minute. Based on findings from recent drilling in Fenner Gap, carbonate bedrock of Paleozoic age, located beneath the alluvial aquifers, contains groundwater and is considered a third aquifer unit (Metropolitan 1999b). Groundwater movement and storage in this carbonate bedrock aquifer primarily occurs in secondary porosity features (i.e. joints, faults, and dissolution cavities that have developed over time). The full extent, potential yield, and storage capacity of this carbonate aquifer have not been quantified at this time. As noted above, granite and metamorphic basement rock form the subsurface margins of the aquifer system in the project area. This basement rock is generally impermeable and typically yields only minor quantities of water to wells (Freiwald 1984).

The primary sources of replenishment to the groundwater system in the Cadiz Valley include direct infiltration of precipitation (both rainfall and snowfall) in fractured bedrock exposed in mountainous terrain and infiltration of ephemeral stream flow in sandy-bottomed washes, particularly in the higher elevations of the watershed. The source of much of the groundwater recharge within the regional watershed occurs in the higher elevations.

A variety of methods have been used to estimate groundwater recharge to the Cadiz Valley. These methods range from simple estimates involving recharge as a percentage of average annual precipitation, to complex relationships between daily precipitation, evapotranspiration, soil moisture, and surface water runoff. After reviewing the Final EIR/Final EIS for the proposed Cadiz Water Project, Bredhoeft (2001) criticized the study stating that recharge values for the basin are undetermined. The FEIR/FEIS suggests that recharge approaches 50,000 acre-feet per year (AFY) while Bredhoeft claims recharge is closer to 5,000 AFY. Bredhoeft's comments on the FEIR/FEIS included a table summarizing other authors' findings using various methodologies to estimate recharge. A summary of Bredhoeft's compilation is provided in **Soil & Water Table 2**, below.

Soil & Water Table 2
Summary of Groundwater Recharge Estimates*

Methodology	Author	Recharge Estimate (AFY)
Watershed Runoff Method	MWD & BLM (1999)	20,000 to 70,000
	GeoScience	50,000
Maxey/Eakin Method	USGS (2000)	2,550–11,200
	Durbin (2000)	
Fenner Gap Groundwater Flow	Friewald (1984)	270
	LaMoreaux (1995)	3,700
	USGS (2000)	2,600–4,300
Chloride Method	USGS (2000)	1,700–9,000
	Durbin (2000)	2,000
Drawdown Associated with Cadiz Co. Pumping	Boyle Engineering (1996)	4,000

*Modified from Bredhoeft 2001

The primary natural outlet, or discharge, of groundwater from the Bristol, Cadiz and Fenner watersheds is evaporation from Bristol and Cadiz dry lakes. Transpiration by vegetation is not a significant source of groundwater discharge, since no native phreatophyte vegetation occurs in the vicinity of the Cadiz Valley.

The total amount of groundwater pumped in and surrounding the Cadiz Valley has been minimal until the last decade. The primary groundwater uses in the region are the Cadiz

Inc. agricultural operations, the Burlington Northern Santa Fe Railroad (BNSF), the various salt-mining companies operating on Bristol and Cadiz dry lakes, and the few residents in and around the communities of Chambless and Essex.

Between 1901 and 1947, approximately 2,365 AF of groundwater, or an average of 50 AFY, was produced from Fenner Valley (Shafer 1964). Between 1948 and 1962, Shafer (1964) estimated that approximately 4 AFY were pumped from Fenner Valley. The sharp drop in production was attributed to a switch from steam- to diesel-powered engines on the railroad. Freiwald (1984) estimates that between 1954 and 1981, groundwater pumping in Fenner Valley remained constant at approximately 7 to 8 AFY. Using Freiwald's (1984) pumping rate estimate for 1954 through 1981, and assuming that this rate continued through 1998, the total volume of groundwater estimated to have been pumped from this valley since 1901 ranges from approximately 2,700 to 2,750 AF. Shafer (1964) reports that approximately 14,300 AF of fresh water were pumped from the Bristol and Cadiz valleys from 1910 (when the first fresh water well was drilled) to 1964, or an average pumping rate of approximately 265 AFY. Assuming these historical pumping rates continued from 1964 through 1998 (not including the Cadiz Inc. agricultural operations), a total of approximately 9,000 additional AF was pumped from these valleys during this time period. In addition, from 1983 through 1998, the Cadiz Inc. agricultural operations produced approximately 61,740 AF of groundwater from its well field. Yearly groundwater production for the Cadiz Inc. agricultural operations has averaged 5,000-6,000 AFY from 1986through 1998. Accordingly, the total amount of groundwater pumped from the Bristol and Cadiz valleys from 1910 through 1998 is approximately 85,000 AF.

With the exception of the areas underlying and immediately adjacent to Bristol and Cadiz dry lakes, the quality of the groundwater in the Fenner Gap portion of the basin is relatively good, with TDS concentrations averaging approximately 300 milligrams per liter (mg/L). The TDS concentration in Fenner Valley groundwater is typically in the range of 300 to 400 mg/L. On Bristol and Cadiz dry lakes, surface water and shallow groundwater evaporation has concentrated dissolved salts, resulting in TDS concentrations as high as 298,000 mg/L (Schafer, 1964). The location of the interface between the low-TDS groundwater and high-TDS groundwater underlying the dry lakes has been mapped on the basis of data from observation wells in the area (Shafer 1964; Rosen 1989). Calcium chloride and sodium chloride are produced by mining operations on both Bristol and Cadiz dry lakes. The highly saline brine is pumped from brine wells and from trenches for concentration in evaporation ponds. These mining operations are conducted on patented lands and on unpatented claims on Federal land administered by the U.S. Bureau of Land Management (BLM). The amount of brine produced is proprietary information, and precise estimates are unavailable.

Within bedrock units exposed in the watersheds tributary to the proposed well site, groundwater may discharge locally to springs. Bedrock hosts for these springs include granitic rock in the Granite and Old Woman mountains, shallow intrusive rock in the Providence Mountains, and volcanic sediments in the Clipper Mountains. Many of these springs occur along joints, fractures, and fault zones in the host rock and at the interface of the fractured bedrock and the alluvial fill. Depth of infiltration and residence time for groundwater within fractured bedrock units may be highly variable. No springs or native phreatophyte vegetation are in the Cadiz BNSF well vicinity. The closest springs to the proposed well site are located in the Granite, Clipper and Old Woman mountains, more than 10 miles from the proposed water supply well as shown in Figure 5.

Cadiz Valley Groundwater Development and Future Uses

Staff notes that Cadiz Incorporated proposes to develop a conjunctive water use program in the Cadiz Valley known as the Cadiz Water Conservation and Storage Project. The following information is excerpted from the project website (http://www.cadizinc.com/our-business/water-resources/index.html):

- *The Project will utilize a portion of the aquifer system that underlies our 35,000-acre landholding in the Cadiz and Fenner Valleys of eastern San Bernardino County and conserve indigenous groundwater that otherwise would be lost to evaporation.*
- *This aquifer system can accommodate both withdrawal of indigenous groundwater and storage of imported water. Total storage capacity of the Project would be approximately 1 million acre-feet. This stored water and/or indigenous groundwater could be delivered to the nearby Colorado River Aqueduct in "dry" years — via a conveyance pipeline — for delivery to participating water providers throughout Southern California.*
- *The aquifer system is naturally recharged by precipitation (rainfall and snow melt) that occurs within a regional watershed of 1,300 square miles. For this reason, any water that is transferred to Southern California will be naturally replenished over time.*
- *In September 2008, we executed a 99-year lease agreement with the Arizona and California Railroad Company (ARZC) to utilize a portion of the railroad's existing right-of-way for the Project's water conveyance pipeline. The pipeline would connect the Project facilities at our Cadiz Valley property with the Colorado River Aqueduct.*
- *In June 2009, we signed Letters of Intent with five Southern California water providers to develop a cost-sharing agreement, finalize terms of pricing, design and capital allocation and work towards implementation of the Project.*
- *In February 2010, we released new details of a comprehensive year-long study measuring the vast scale and recharge rate of the Cadiz aquifer system. The study was conducted by internationally recognized environmental consulting firm CH2M Hill at the Project area utilizing new models produced by the U.S. Geological Survey in 2006 and 2008. CH2M Hill and additional hydrology experts that have peer-reviewed the work confirmed the aquifer system can sustainably support the Cadiz Project.*

BLM and The Metropolitan Water District of Southern California previously completed a joint FEIR /FEIS for a conjunctive water management program (Cadiz Groundwater Storage and Dry-year Supply Program*)* in the Cadiz Valley Groundwater Basin. It appears that project will not be implemented. Cadiz, Inc., plans to submit a new application for development of the project described above. This new project would be located within a mile of the proposed project water supply well. The potential impacts of this program on the project water supply are discussed below in the water supply and cumulative impacts sections.

Hydrology

The project site is in the southwest portion of the Mojave Desert, which is characterized by broad alluvial fans and fluvial terraces, playas, and scattered mountains. There are no perennial streams within the project site or in the area. The nearest major ephemeral stream is the Mojave River which is approximately 15 miles northwest of the site and is separated from the site by a watershed divide. The project site is situated within the Troy Valley hydrologic subarea, as defined by the Lahontan Region basin plan (California RWQCB, 2005).

The proposed site occupies a broad alluvial fan/plain with relatively little topographic variation (see **Soil & Water Figure 1**, Site Topography). An alluvial fan is a sedimentary deposit located at a topographic break, such as the base of a mountain front, escarpment, or valley side, that is composed of stream flow and/or debris flow sediments and has the shape of a fan, either fully or partially. The National Flood Insurance Program defines alluvial fan flooding as “flooding occurring on the surface of an alluvial fan or similar landform which originates at the apex and is characterized by high velocity flows; active processes of erosion, sediment transport, and deposition; and, unpredictable flowpaths.” It is the unpredictability of flowpath that is key in the development of a risk assessment for a project located on an alluvial fan.

The overall landform is relatively flat with shallow slopes trending from the north to south and in some areas to the southwest. The ground generally slopes in a northeast-to-southwest direction, ranging from 2% to 5% across the site, except for the western portion where the slope reduces to 1%. There are occasional small hills (buttes) and sand dune areas on the project site. Several drainage patterns occur on the site. These drainage patterns follow the gradient of higher elevations in the mountains north and east of the site towards lower elevations southerly and westerly across the site. The land between I-40 and the BNSF railroad slope to the west, ultimately towards Troy Dry Lake, a playa that is located west of the site. There are no well-defined channels on-site, although some discontinuous flood terraces occur in a few areas on-site. The drainage features on-site are not well-defined channels resulting from active flow but consist of discontinuous floodplains with areas that exhibit a mixed pattern of sheet flow or shallow concentrated flow across isolated, wide areas of land. Relatively undefined drainage features traverse most of the site with evenly distributed desert scrub vegetation throughout.

Surface water flow does not occur on-site in most years. According to the NOAA Atlas 14 internet-based Precipitation Frequency Data Server, the 100-year 24-hour storm event will generate approximately 3.5 inches of rain. When water does flow on-site, it is usually the result of precipitation occurring during 5- to 10-year storm events. These flows are ephemeral and occur only during periods of brief intense rainfall.

Storm water runoff and flows from flash floods on-site would represent surface water in the form of storm water runoff that could potentially be regulated pursuant to Porter Cologne and may be subject to jurisdiction by the CDFG pursuant to Section 1600 of the California Fish and Game Code. Concentrated flood flows through culverts under the railroad and highway may be potentially regulated.

In general, drainage in Phase 1 of the project area flows southwest from the Cady Mountains, however, along the south boundary of Phase 1 some flows are diverted by the railroad and flow straight west (see **Soil & Water Figure 2**, Regional Watersheds and **Figure 3**, CDFG Flow Paths). As shown, there is an offsite watershed area of nearly 20 square miles which drains either directly to the Phase 1 project site or drains to the railroad tracks and is partially diverted into the Phase 1 site. The Phase 1 site is nearly 10 square miles, so the total watershed area for Phase 1 is approximately 30 square miles. Several blue line streams pass through the Phase 1 project area. Many of these coalesce into larger washes and all drain to the railroad at the southern boundary of the Phase 1 site. The runoff from the Phase 1 site flows through the existing trestles at the railroad. Some of the trestles may have insufficient capacity to pass 100-year flows and some flow is diverted west along the railroad on the southern boundary of the project site and eventually flows through trestles along the southern boundary of the Phase 1 site. It is assumed that the 100-year flood will generally be conveyed along the railroad and through the trestles along the railroad right of way. This right of way is excavated and maintained by the BNSF Railroad Company to allow the water to pond and flow at low velocities. The right of way is delineated along the north line with a barbed wire fence.

The offsite watershed impacting the Phase 1 site emanates from the Cady Mountains which flank the northeast side of the project area. Field investigation and review of the topographic maps suggest that the watershed consists of a series of alluvial fans which coalesce to form a bajada. A bajada is a broad slope of debris, spread along the lower slopes of mountains by descending streams; a bajada is often formed by the coalescing of several alluvial fans. From review of the topographic mapping in the field, it appears that the areas with the highest current risk of active flooding are generally shown on the USGS 7.5 -minute quadrangles. These areas are indicated as blue lines and as shaded wash areas. While these areas are easily identifiable on the mapping, they may be occasionally difficult to identify in the field. Washes are often well incised near the base of the mountains. However, these same washes transition into sheet flow and shallow concentrated flow areas which do not have a well incised channel or a series of small channels which are braided, each of which may carry a fraction of the total flow. Sheet flow is defined as flow of water as broad sheets that are unconfined by channel boundaries. Sheet flow areas appear to be more prevalent at distal locations from the apex of the fan. These locations are primarily within the proposed site development area. Because the sheet flow and braided wash flow may carry a sediment load and follow unpredictable flow paths, development within these areas could be impacted by the storm water.

The watershed affecting the Phase 1 area is located in the Cady Mountains to the north of the project site. Flows that traverse the site emanate from the Cady Mountains watershed, drain through the trestles on the railroad and then continue west through the Phase 2 site. Upstream of the railroad trestles, the railroad embankment has diverted and channelized much of the flow creating numerous ponding areas. The trestles and ponding areas attenuate the peak flow and allow most of the sediment to drop out on the upstream (north or east) side of the railroad embankment. Additional drainage flows south from the Cady Mountains, west of the Phase 1 property limits, is diverted at the railroad tracks and then flows south in the Phase 2 area. In addition to the Cady Mountain watershed, a second watershed is located south of the freeway and includes the Pisgah Crater and lava flow area. Runoff from this watershed generally flows either north or west. It reaches I-40 and then continues north through numerous culverts and bridges into the Phase 2 project area. After flowing through the culverts at the highway, the runoff commingles with the flow from the Cady Mountains and then flows west to the outfall. As with the Cady Mountain watershed, the Pisgah watershed runoff is diverted by the I-40 road embankment and associated dikes and berms and is routed through culverts. Ponding occurs at these culvert locations and this reduces the peak flow and sediment loads which pass through the culverts.

Soil Erosion Potential

Current soil survey data is limited in much of the Mojave Desert due to the lower potential for agricultural use. Detailed soil mapping has not been performed by NRCS for the site. However, soil mapping in the general area is being conducted by NRCS. The results of that mapping effort will not likely be available for a few years.

Available soil data for the project area are derived from the STATSGO soil database (STATSGO 2001) which presents mapping at the association level. The mapped soil associations database contains several soil series within each map unit. Primarily two soil associations would be affected by project construction; the Carrizo-Rositas-Gunsight and the Nickel-Arizo-Bitter associations. The Carrizo-Rositas-Gunsight soil association occupies the majority of the site, while the Nickel-Arizo-Bitter association is present over much of the southern portion of the site, south of the BNSF rail lines. The Rock Outcrop-Lithic Torriorthents-Calvista association is present in the mountains along the northern site perimeter and the Rock Outcrop-Upspring-Sparkhule association is present on the southwest corner of the Project Site, as well as north and northwest of the site.

Soil and Water Table 3
Summary of Soil Characteristics

Soil	Texture	Depth of Surface Layer (Inches)	Land Capability Class[1]	Wind Erodibility Group[2]	Erosion (K) Factor[3]	Natural Drainage Class[4]	Permeability in inches per hour[5]
Carrizo-Rositas-Gunsight	Loamy Fine Sand	9	7S	2	0.15	Somewhat Excessively Drained	6–20
Nickel-Arizo-Bitter	Gravelly Sandy Loam	7	7S	5	0.10	Well Drained	2–6
Rock Outcrop-Lithic Torriorthents-Calvista	Gravelly Loam	8	7E	8	0.20	Excessively Drained	2–6

Notes:
1 - Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Class 7 soils have very severe limitations that make them unsuitable for cultivation and that restrict their use mainly to grazing, forestland, or wildlife habitat. Class 8 soils and miscellaneous areas have limitations that preclude commercial plant production and that restrict their use to recreational purposes, wildlife habitat, watershed, or esthetic purposes.

2 - Wind erodibility groups range from 1 to 8, with 1 being highly erodible and 8 having low erodibility.
3 - This is an index of erodibility for standard condition and includes susceptibility of soil to erosion and rate of runoff. Low K values (below 0.15) indicate low erosion potential. High K values (above 0.4) are highly erodible. See report text for additional information.
4 - Table presents nonirrigated land capability classification. Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Capability classes range from 1 to 8, with higher numbers indicating progressively greater limitations and narrower choices for use: Class 1 - slight limitations that restrict use; Class 2 - moderate limitations restricting choice of plants, or requiring moderate conservation practices; Class 3 - severe limitations restricting plant choice or requiring conservation; Class 4 - severe limitations, requiring very careful management; Class 5 - subject to little or no erosion, but mainly restricted use to pasture, rangeland, forestland, wildlife habitat; Class 6 - severe limitations, generally unsuitable for cultivation, restrictions per Class 5; Class 7 - severe limitations, unsuitable for cultivation, restrictions per Class 5. Capability subclasses: e - erosion is main hazard unless close-growing plant cover maintained; s - soil limited because shallow, droughty or stony; c - chief limitation is very cold or dry climate. Capability units (after '-') are soil groups within a subclass with similar suitability for crops and pasture plants with similar management requirements and productivity.
5 - Permeability refers to saturated hydraulic conductivity for the surface layer. Permeability rates listed are minimum and maximum expressed in inches/hr.
Source: Except as otherwise indicated, table source is SES 2008a Section 5.4.

Carrizo soils are formed in alluvium present primarily on flood plains, alluvial fans, fan piedmonts, and bolson floors, with slopes up to 15%. These soils are typically very deep gravelly sand. The upper 2 inches is extremely gravelly sand with about 65% gravel. Below the upper 2 inches, the material contains coarse sand and averages 70% gravel and coarser materials, with a clay content less than 8%. The soils are excessively drained with negligible or very low runoff and rapid or very rapid permeability.

Rositas soils are formed in sandy aeolian material on dunes and sand sheets, with slopes up to 30%. These soils are typically fine sand with up to 5% gravel and up to 10% clay. Rositas soils are very deep and somewhat excessively drained, with negligible or low runoff and rapid permeability.

The Gunsight series is comprised of very deep calcareous alluvial soils on fan or stream terraces with slopes up to 60%. The soils are very gravelly loam, with gravel content ranging from 40% to 75% gravel and an average of less than 18% clay. The soils are somewhat excessively drained with very low to high runoff and moderate or moderately rapid permeability.

Nickel soils are derived in alluvium from mixed rock sources and are present on fan remnants with slopes up to 35%. The soils are very gravelly loam, with gravel content ranging from 25% to 75%, generally increasing with depth and typically less than 15% clay. The A horizon contains approximately 20% gravel and cobbles and is classified as gravelly very fine sandy loam. The soils are very deep, well drained with very low to medium runoff and moderate permeability. Nickel soils are commonly associated with Arizo and Bitter soils.

Arizo soils are also formed in mixed alluvium and are present on recent alluvial fans, inset fans, fan apron, fan skirts, stream terraces, and in intermittent stream and channel floodplains. The material is typically very gravelly fine sand with 35% to 80% gravel and cobbles, increasing with depth. The A horizon is very gravelly fine sand with 35% pebbles. The soils are very deep, excessively drained, with negligible to medium runoff and rapid to very rapid permeability.

Similar to Arizo and Nickel soils, Bitter soils are formed in mixed alluvium. They are present on dissected old fans between lower recent fans and the toes of steep slopes generally ranging from 2% to 15%. The material is extremely gravelly sandy loam with 45% to 75% pebbles and cobbles. The upper horizons are composed of extremely to very gravelly sandy loam with 50% pebbles and cobbles. Bitter soils are well drained with medium runoff and moderately slow permeability.

The rock outcrop classification is typically observed on mountainsides, ridges, and rugged hills. It can be composed of many rock types, typically granite, quartz monzonite, basalt, dacite, limestone, quartz, mica, schist, and fanglomerate.

Lithic torriorthents (shallow rocky soils) are present between rock outcrop areas, in small depressions and on relatively stable hillsides. Slopes typically range from 15% to 50%. The soil varies from sandy loam to very gravelly sand. They form in material weathered from granitic rock, with hard, fractured rock present at a depth of 1 to 18 inches. These soils are very shallow and shallow, well drained, with medium to rapid runoff and a high water erosion hazard.

The Calvista series consists of sandy loam formed from granitic rock with seams of calcite. It is typically present on slopes of 2% to 30% and mountain ridges, buttes and domes in Southern California deserts. Hard rock is generally present at a depth of 14 to 20 inches, although rock outcrops may be present. The gravel content is typically less than 35%. Calvista soils are shallow and well drained soils, with medium to rapid runoff and moderately rapid permeability.

Project Water Supply

Groundwater is the primary water source available in the site vicinity. The applicant proposes to use groundwater obtained from a well located approximately 64 miles away from the site in the area know as Cadiz. The well is owned by Burlington Northern Santa Fe (BNSF) and is known as the Cadiz BNSF well. The groundwater extracted from this well is proposed to be used for all power plant construction and operation.

The groundwater will be shipped to the site via BNSF rail cars.

Potable Water

The applicant proposes to use treated groundwater for potable needs. The groundwater will first be demineralized, then stored in a designated storage facility equipped with chemical dosage for disinfection. This treated potable water will be available at the Main Services Complex and may be piped to the Satellite Service Complex. If potable water is not piped to the Satellite Services Complex, bottled water will be made available.

Construction Water

Water demands during construction of the project will be relatively light for an effort as large as that proposed. Vertical foundation elements (metal poles) for the SunCatchers will be inserted into the subsurface using track driven vibratory equipment. The vibratory insertion method eliminates conventional drilling techniques that would generate cuttings that would require dust suppression for stockpiling, transferring, trucking and disposal of the cuttings. The track mounted equipment will also reduce ground disturbance (rutting) by spreading the load over a larger surface area.

Site construction will be accomplished in two phases, Phase 1 and Phase 2. Phase 1 construction will take place during the first 12-month period, consisting of construction of the primary access routes, the construction laydown areas, the rough grading for the Main Services Complex, the Satellite Services Complex and the substation sites, as well as the clearing areas disturbed by the construction of each 18MW or 24MW solar group. The total water use for the first 12 months of construction is estimated to be 79,780,000 gallons or approximately 245 AF.

Phase 2 will take place during construction months 13 through 40. Phase 2 will mostly involve construction of additional access roads and continued solar field development. Similar to Phase 1, construction during the initial Phase 2 12- month period (months 13 through 24) will use the most water. The total water use during the first 12-month period of Phase 2 construction (months 13 through 24) is estimated to be 74,880,000 gallons or approximately 230 AF. Water demands during final construction (months 24 to 40) are expected to drop off dramatically to average approximately 25,000,000 gallons or approximately 77 AF per year.

The applicant estimates that during the 40 months of project construction, the water demand for combined construction and dust suppression would be approximately 556 AF (**Soil & Water Table 4**). During this 40-month construction period, water use is expected to vary from approximately 13.5 million gallons (41.5 AF) per month (month 2), to 2 million gallons (6.1 AF) per month (after the 25th month). The expected average water consumption for the project during the first 24 months of construction is approximately 77 million gallons (238 AF) per year.

Soil & Water Table 4
Construction Water Use

Month After Start of Construction	Dust Control Volume of Water (millions of gallons)	Construction Volume of Water (millions of gallons)	Total Construction Volume (millions of gallons)
Phase 1Begins			
1	3.64	1.56	5.20
2	7.28	6.24	13.52
3	6.24	6.24	12.48
4	4.16	1.04	5.20
5	3.12	1.04	4.16
6	4.16	2.08	6.24
7	4.16	3.64	7.80
8	3.12	3.64	6.76
9	3.12	3.64	6.76
10	3.12	2.08	5.20
11	1.26	1.04	2.30
12	3.12	1.04	4.16
Phase 2 Begins			
13	6.24	2.08	8.32

Month After Start of Construction	Dust Control Volume of Water (millions of gallons)	Construction Volume of Water (millions of gallons)	Total Construction Volume (millions of gallons)
14	7.28	6.24	13.52
15	6.24	1.56	7.80
16	4.68	1.56	6.24
17	4.68	1.04	5.72
18	4.16	1.56	5.72
19	4.68	1.56	6.24
20	3.64	1.56	5.20
21	3.64	1.04	4.68
22	3.64	1.04	4.68
23	3.64	0.52	4.16
24	2.60	0	2.60
25	2.08	0	2.08
26	2.08	0	2.08
27	2.08	0	2.08
28	2.08	0	2.08
29	2.08	0	2.08
30	2.08	0	2.08
31	2.08	0	2.08
32	2.08	0	2.08
33	2.08	0	2.08
34	2.08	0	2.08
35	2.08	0	2.08
36	2.08	0	2.08
37	0.52	0	0.52
38	0.52	0	0.52
39	0.52	0	0.52
40	0	0	0
Total Construction Water Volumes	128.14 MG or **393 AF**	53.04 MG or **163 AF**	181.18 MG or **556 AF**

Source: SES 2008a Table 3-6

Water trucks will be used throughout the duration of the construction phase for the project. Truck filling stations will be located at the Main Services Complex, at the Satellite Services Complex, and at various temporary truck filling stations throughout the project site. An underground waterline connecting the Main Services Complex to the Satellite Services Complex will be installed beneath the BNSF railway to supply groundwater for dust control for the portion of the site located south of the BNSF railway.

Operations Water

Due to the technology proposed for this project (Stirling engines), water use during electric generation will be minimal. The applicant considers imported groundwater as "raw" water that will require treatment to remove dissolved solids for SunCatcher mirror wash water applications and additional treatment to meet drinking water quality standards. Water treatment processes identified by the applicant for demineralization are Reverse Osmosis (RO) and ion exchange. Potable water consumption, groundwater treatment, and SunCatcher mirror washing under regular monthly maintenance routines will require approximately 12.5 gpm of water per day. A maximum requirement of approximately 21 gpm of water per day will be needed during the months when each SunCatcher receives a scrub wash.

Water consumption during operation will be limited to mirror washing (13.98 AFY), water treatment (0.84 AFY), potable use (2.59 AFY), and dust control (2.5 AFY). Additionally, water will be used to generate hydrogen used in the SunCatcher engines. The applicant estimates that 205 gallons per day (0.23 AFY) of water will be required to produce a sufficient volume of hydrogen for power plant use. The applicant estimates that the total maximum consumptive use of groundwater for operation of the power plant will be approximately 20.14 AFY (see **Soil & Water Table 5**, below).

Soil & Water Table 5
Operations Water Usage Rates

Water Use	Daily Average (gallons per minute)	Daily Maximum (gallons per minute)	Annual Usage (acre-feet)
Equipment Water Requirements			
SunCatcher Mirror Washing	8.67	14.47	13.98
Water Treatment System Discharge			
Brine to Evaporation Ponds	0.52	0.83	0.84
Potable Water Use			
For drinking and sanitary water requirements	1.61	1.94	2.59
Dust Control			
Groundwater for dust control during operations	1.55	3.10	2.50
Hydrogen Generation			
For hydrogen gas extraction	0.14	0.28	0.23
Totals	**12.49**	**20.62**	**20.14**

Notes:
1 - Based on 34,000 SunCatchers requiring a monthly wash with an average of 14 gallons of demineralized water per spray wash and a 5-day work week (21 work days per month).

2 - During a 3-month period, all SunCatcher mirrors are given a scrub wash requiring up to 3 times the normal wash of 14 gallons per SunCatcher. Therefore, the Daily Maximum usage rate is based on two-thirds of the SunCatchers receiving a normal wash and one-third receiving a scrub wash.
3 - Based on every SunCatcher having approximately 8 normal washes per year with one additional scrub wash.
4 - Based on the maximum amount of demineralized water required for mirror washing and assumes a decrease in raw water quality requiring an additional 20% of system discharge.
5 - Assumes 30 gallons per person per day for 182 people.
6 - Maximum amount assumes a 20% contingency over the Daily Average.
7 - Assumes a 6-day work week and average daily usage.
8 - Assumes 5,000 gallons per day.
9 - Assumes up to 10,000 gallons per day.
10 - Assumes daily average dust control operations.
Source: SES 2008a Table 5.5-2 updated using TS 2010l

Wastewater

Sanitary

Initially, control of sanitary waste will be accomplished using portable chemical toilets. No public or private entities manage sanitary wastewater in the vicinity of the project site. Therefore, construction of a permanent onsite wastewater disposal system consisting of a septic tank and leach field will be completed to handle sanitary wastewater. According to the applicant, a facility of this type will be designed to meet the requirements of the Lahontan RWQCB and the San Bernardino County Public Health Department, and will meet operation and maintenance guidelines required by the California Department of Public Health.

Construction Wastewater

Improper handling or containment of construction wastewater could cause a broad dispersion of contaminants to soil or groundwater. Discharge of any non-hazardous construction-generated wastewater would require compliance with discharge regulations. Sources of wastewater would include equipment wash water and piping and vessel hydrostatic test water. Equipment wash water would be transported to an appropriate treatment facility. Hydrostatic test water would be reused to the extent possible and, pending analytical results of the water, would be discharged to land or trucked offsite to an appropriate treatment and disposal facility.

Process Wastewater

Extracted groundwater will require treatment to remove dissolved solids for SunCatcher mirror wash water applications and additional treatment will be required to meet current drinking water quality standards. The water will be demineralized to prevent mineral deposits forming on the SunCatcher mirrors. Treatment processes proposed to remove total dissolved solids (tds) include reverse osmosis (ro) and ion exchange. The wastewater generated by the ro unit will contain relatively high concentrations of tds. The applicant proposes to discharge the high tds wastewater into two double-lined evaporation ponds. Each pond will be designed to contain 1-year of discharge flow, estimated to total 3 million gallons. Discharge to the ponds will alternate on an annual basis, allowing one pond to undergo evaporation while the other receives the effluent. The applicant estimates that the tds concentration in the wastewater will be approximately 3,600 mg/l.

C.7.4.2 ASSESSMENT OF DIRECT AND INDIRECT IMPACTS AND DISCUSSION OF MITIGATION

The direct and indirect impact and mitigation discussion presented below is divided into a discussion of impacts related to construction and a discussion of impacts related to operation. For each potential impact evaluation, staff describes the potential effect and applies the threshold criteria for significance to the facts. If mitigation is warranted, staff provides a summary of the applicant's proposed mitigation and a discussion of the adequacy of the proposed mitigation. In the absence of an applicant-proposed mitigation or if mitigation proposed by the applicant is inadequate, staff recommends its own mitigation measures. Staff also recommends specific conditions of certification related to a potential impact to assure that the mitigation measures are implemented.

Construction Impacts and Mitigation

The project will be developed in two phases. Construction of Phase 1 is expected to take 12 months to complete and Phase 2 is expected to take 28 months. Construction will, therefore, occur over three or four winter seasons. Construction of the proposed project would include soil excavation, grading, installation of utility connections, installation of finned pole SunCatcher foundations, road building, paving, erection of structures and the use of groundwater. The amount of temporary construction and permanent disturbance generated by these activities is shown in **Soil & Water Table 6**. Groundwater use would primarily be for dust suppression, hydrostatic testing of the project's pressure vessels, moisture conditioning compacted soil and mixing concrete. Potential impacts to soils related to increased erosion or release of hazardous materials are possible during construction. Potential storm water impacts could result in an increase in flooding and sedimentation downstream if there is an increase in runoff flow rates and volume discharges from the site. Water quality could be impacted by discharge of hazardous materials released during construction. Project water demand could decrease the quantity of groundwater available. Potential construction-related impacts to soil, storm water, and water quality or quantity, including the applicant's proposed mitigation measures and staff's proposed mitigation measures, are discussed below.

Soil & Water Table 6
Estimated Disturbed Area Summary

Project Component Item	Area		Proposed Length	Comments
	Construction Disturbance	Operations Permanent Disturbance		
Off-Site Development				
Off-site access road	11 acres	11 acres	3 miles	30-foot width for roadway and drainage from I-40
Off-site transmission line	0.9 acres	Included below	0.14 miles	50 feet each side of center
Tower structures	Included above	0.02 to 0.05 acres		1 to 2 towers x 1,024 SF per tower
Subtotal	**12 acres**	**11 acres**		

Project Component Item	Area		Proposed Length	Comments
	Construction Disturbance	Operations Permanent Disturbance		
On-Site Balance-of-Plant Development				
Construction staging and construction administration area near BNSF/ Southern California Edison Pisgah Substation	26 acres	N/A		Located in Phase 1, approx. 0.5 mi north of SCE Pisgah Substation
Construction staging and construction administration area at Hector Road	26 acres	N/A		Located in Phase 2
On-site construction laydown	11 acres	N/A		Located adjacent to MSC
Site boundary fence line	55 acres	28 acres	38 miles	12-foot width construction access; 3 feet each side of the fence
Site paved roadways	138 acres	111 acres	38 miles	30-foot width for roadway and drainage
Unpaved perimeter roadways	15 acres	15 acres	10 miles	12 feet wide
Main Services Complex	42 acres	14.4 acres		Construction disturbance based on buildings, parking, assembly, and construction areas
Satellite Services Complex	21 acres	10 acres		Construction disturbance based on buildings, parking, assembly, and construction areas
Assembly buildings and storage	Included above	N/A		Post construction the assembly building and their associated laydown areas will be decommis-sioned and dishes installed on this acreage. The MSC assembly buildings used during construction of Phase 1 will be moved to the SSC for the construction of Phase 2
Subtotal	**334 acres**	**178 acres**		
On-Site Wet and Dry Utilities Access				
Water pipeline	3.6 acres	2.9 acres	2 miles	Disturbance based on 2-in diameter waterline from MSC to SSC; 15-ft wide construction access; 12-ft wide operations access

Project Component Item	Area		Proposed Length	Comments
	Construction Disturbance	Operations Permanent Disturbance		
On-site electrical and communications overhead service	5 acres	N/A	9,068 feet	12 feet each side of center
Calico Solar Substation	4 acres	2.8 acres		530 feet by 555 feet
On-site transmission line	10.3 acres	N/A	1.7 miles	50 feet each side of center
Transmission access road	Included above	2.5 acres	1.7 miles	12 feet wide
Transmission tower structures	Included above	0.3 acre		12 to 14 towers at 1,024 SF per tower
34.5kV overhead runs to Calico Solar Substation	6.0 acres	N/A		17 miles by 12 feet wide with a significant portion overlapping other construction disturbed areas (75%)
Subtotal	**29 acres**	**9 acres**		
Solar Field Development = 567 by 1.5MW Solar Groups 2,4				
SunCatcher drainage swale	874 acres	874 acres		40 feet wide by 56 feet long per 2 SunCatchers
SunCatcher foundation	2.5 acres	2.5 acres	12 to15 ft	2-ft diameter post
SunCatcher pad clearing	110 acres	110 acres		12 feet wide by 12 feet long cleared pad area for each SunCatcher, excluding foundation area
North-south access routes	262 acres	262 acres	180 miles	12-foot-wide road servicing 2 SunCatchers
East-west access routes	31 acres	31 acres	21 miles	12-foot-wide road within area of limited disturbance constructed over 600V Collector Cable; 40 feet long by 12 feet wide per 12 SunCatchers
East-west PCU access routes	702 acres	702 acres	386 miles	15-foot-wide road servicing each SunCatcher PCU and providing east-west access to dish groups over generator group feeders
Debris basins for off-site flows	220 acres	220 acres		Located along northern project boundary
Debris basins for on-site flows	65 acres	65 acres		Located throughout the site

Project Component Item	Area		Proposed Length	Comments
	Construction Disturbance	Operations Permanent Disturbance		
Electrical Collection System				
North-south 600 V underground	60 acres	N/A		Cable disturbance based on north-south cables outside of roadways cable trench based on 2foot each side of center of cable, excluding previously accounted disturbance
1750 kVA transformers, junction boxes, and east-west 600 V underground	235 acres	2 acres		1 transformer with collector panel and 4 junction boxes per 1.5 MW with east-west 600 V cables disturbance based on 41 feet by 88 feet area per group of 12 SunCatchers
34.5kV underground	38 acres	N/A		Cable trench based on 6 feet each side of center, excluding previously accounted disturbance
Subtotal	**333 acres**	**2 acres**		
Total Area	**3,270 acres**	**2,712 acres**		Includes 10% contingency

Source: SES 2008a

Soil Erosion Potential by Water and Wind

Construction activities can lead to adverse impacts to soil resources including increased soil erosion, soil compaction, loss of soil productivity, and disturbance of soils crucial for supporting vegetation and ephemeral water dependant habitats. Activities that expose and disturb the soil leave soil particles vulnerable to detachment by wind and water. Soil erosion results in the loss of topsoil and increased sediment deposition downstream.

The magnitude, extent, and duration of those impacts depends on several factors, including the exposure of the soils to water and wind, the soil types affected, and the method, duration, and time of year of construction activities. Prolonged periods of precipitation or high intensity and short duration runoff events coupled with earth disturbance activities can result in accelerated onsite erosion. In addition, high winds during grading and excavation activities can result in wind borne erosion leading to increased particulate emissions that adversely impact air quality. The implementation of appropriate erosion control measures would help conserve soil resources, protect downstream properties and resources, and protect air quality.

Staff evaluated the potential impacts to soil resources, including the effects of construction activities that could result in erosion and downstream transportation of soils and the potential contamination of soils and groundwater. There are extensive regulatory programs in effect that are designed to prevent or minimize these types of impacts. These programs are effective, and absent unusual circumstances, an applicant’s ability to identify and implement program-approved Best Management Practices (BMPs) to prevent erosion or contamination is sufficient to ensure that these impacts would be less than significant. In addition, soils would be protected by the development and implementation of grading plans and a Drainage, Erosion and Sedimentation Control Plan (DESCP).

Although these programs and BMPs are generally effective on most projects, staff considers that the proposed project does constitute an unusual circumstance. Compared to other projects previously constructed on active alluvial fans, the proposed project is of a very large scale.

The project site will be developed utilizing the existing land features without undergoing major grading operations. Off-site flow will be intercepted prior to entering the project site using large debris basins located at the toe of each mountainous drainage basin near the northern project boundary. These project debris basins are designed to retain storm water discharge and associated debris resulting from a 100-year storm. In addition to intercepting debris from the mountains, the proposed debris basins will also provide for peak runoff attenuation of the surface flows. The design attempts to protect the project site from flooding, sediment deposition, and scour.

Onsite runoff will be intercepted in detention basins constructed onsite as shown in **Soil & Water Figure 4**, Drainage Layout, and sized to retain the 100-year onsite runoff and debris flows. The onsite basins are designed to retain 4-years of average sediment accumulation for the area or subarea they are designated to serve. After the 4-years average sediment accumulation is captured, the sediment will be removed from the basins and distributed on site.

The SunCatchers will be constructed in parallel rows, with access roads built on alternating rows. To minimize erosion and enhance storm water infiltration, rows where roads are not constructed will retain native vegetation. To minimize shading on SunCatchers and prevent potential brush fire hazards, the vegetation will be trimmed. Brush trimming will consist of cutting the top of the existing brush while leaving the existing native plant root system in place, thereby minimizing soil erosion. After brush has been trimmed, blading for roadways and foundations will be conducted between alternating rows to provide access to individual SunCatchers. Blading will consist of limited removal of terrain undulations to maintain a 10percent maximum slope grade.

Localized rises or depressions within the individual 1.5 MW solar groups will be removed to provide for proper alignment and operation of the individual SunCatchers. Ground disturbance will be minimized wherever possible. The blading operations will generally keep native soils within 100 feet of the pre-development location, with no hauling of soils across the site. To minimize site disturbance, the construction for unpaved north-south access routes will be located along the center of a 144-foot area along every other north-south column of SunCatchers. To protect the bladed areas from surface erosion, drainage swales will be constructed to intercept and convey the surface low-flows from undisturbed natural areas to debris basins. Paved roadways will be constructed as close to the existing topography as possible, with limited cut-and-fill operations to maintain roadway design grade of less than 10%.

Grading operations will also be required for laydown areas, building foundations and pads and parking areas in the Main Services Complex, Satellite Services Complex, and substation areas. The clearing, blading, and grading operations will be undertaken using standard contractor heavy equipment. The equipment will consist of motor graders, bulldozers, elevating scrapers, hydraulic excavators, rubber tire loaders, compacting rollers, and dump trucks.

The project site layout will maintain the local pre-development drainage patterns where feasible, and water discharge from the project site will remain at the western boundary. The paved roadways will have Arizona Crossings (roadway dips) or low-flow culverts consisting of a small-diameter storm drain with a perforated stem pipe, as needed to cross the minor or major channels/swales. It is expected that storm water runoff will flow over the crown of the paved roadways, which are typically less than 6 inches from swale flow line to crown at centerline of roadway, thus maintaining existing local drainage patterns during storms. No crown is anticipated if polymeric stabilizers are used, further reducing drainage conveyance impacts. Where needed, unpaved roads will utilize low-flow culverts under solar field access routes. Debris basins will be added throughout the project site for low-flow surface runoff detention in lieu of culverts. The design of the drainage facilities will be based on BMPs for erosion and sediment control.

Localized channel grading is proposed to take place on a limited basis to improve channel hydraulics in the vicinity of BNSF railway right-of-way to control the surface runoff. In addition, the Main Services Complex will be protected from a 100-year flood by berms and/or channels that will direct the flow around the perimeter of the building site, if required.

The proposed arterial roadway section between the Main Services Complex and I-40 will be a designated evacuation route. As such, the driving surface will be constructed at an elevation above the projected profile of a 25-year storm event. In addition, overflow resulting from the 100-year storm event will be limited to a depth not to exceed 7 inches.

It is anticipated that roadway maintenance will be required after rainfall events. For minor storm events, it is anticipated that the unpaved roadway sections may need to be bladed to remove soil deposition, along with sediment removal from debris basins and stem pipe risers at the culvert locations. For major storm events, in addition to the aforementioned maintenance, roadway repairs may be required due to possible damage to pavement where the roadways cross the channels and where the flows exceed the culvert capacity. Soft bottom storm water detention basins will be constructed to mitigate the increase in runoff from the proposed building sites. Rainfall from paved areas and building roofs will be collected and directed to the storm water detention basins. The storm water detention basins will be sized to hold the entire volume from the proposed building sites resulting from a 24-hour, 100-year storm. The detention basin will be designed so that the retained flows will empty within 72 hours after the storm to provide mosquito abatement. This design can be accomplished by draining, evaporation, infiltration, or a combination thereof. The post-development flow rates released from the project site are expected to be less than the pre-development flow rates. Except for the building sites, the majority of the project site will remain pervious, as only a negligible portion of the site will be affected by pavement and SunCatchers foundations.

Site drainage during construction will follow predevelopment flow patterns, with ultimate discharge to the BNSF ROW and ultimately at the westernmost property boundary.

Debris basins and/or low-flow culverts consisting of a small-diameter storm drain with a perforated stem pipe will be installed for sediment control and to provide for storm peak attenuation. BMPs for erosion and sediment control will be used in combination with debris basins for roadway crossing of major washes. In the Main Services Complex, the storm water will be directed to a detention basin, where the site runoff will infiltrate and/or evaporate. The detention basin will be sized to meet the San Bernardino County development criteria.

The temporary erosion and sedimentation control measures to be used during construction will be designed to prevent sediment from being displaced and carried off-site by storm water runoff. Before beginning excavation activities, debris basins, silt fence, straw bales, or other BMPs will be constructed/installed along the perimeter of the Project, where minor runoff to off-site areas could occur. Debris basins will be constructed for the major site runoff discharge and will also provide for low flow detention. The silt fence will filter sediments from construction runoff. Berms with perforated risers will be used at road crossings and other locations as needed to control sediment transportation. During construction, the extent of earth disturbances will be minimized as much as is practical. A sediment trap will be constructed for the major site runoff discharge. The sediment trap will be located immediately upstream of the property boundary.

Diversion swales with berms will be constructed as necessary to divert runoff from off-site areas and on-site undisturbed areas around the construction site. Temporary BMP control measures will be maintained during the rainy season as necessary throughout the construction period.

Soil erosion and loss of soil due to project activities could be substantial and would need to be mitigated. The proposed erosion and sedimentation control measures include, but are not limited to: scheduling installation of BMPs to precede or coincide with construction activities; debris and retention basins; preserving the existing vegetation to the extent possible; wetting or using soil binders or weighting agents in active construction and laydown areas; controlling speed on unpaved surfaces; placing gravel in entrance ways; and use of straw bales, silt fences, and earthen berms to control runoff. Staff recommends the development and implementation of a DESCP in accordance with Condition of Certification **SOIL&WATER-1** to ensure adequate BMPs are in place to mitigate potential erosion and loss of soil. In addition, Condition of Certification **SOIL&WATER-2** would require the project owner to develop and implement a construction Storm Water Pollution Prevention Plan (SWPPP) and comply with the dredge and fill requirements that are currently under development with the Lahontan RWQCB. These requirements will be identified in the Supplemental Staff Assessment.

The vast majority of the Project grading and excavation will occur on the Project site. Known onsite soil types that will be affected by Project grading and excavation are listed in Section C.7.4.6. The wind erosion hazard is low to high. During construction, the area within the plant site fence line (8,200 acres) will be disturbed.

During construction, the surface of the disturbed areas will be devoid of vegetation and there will be the highest potential for erosion, as well as associated effects including soil loss and increased sediment yields downstream from disturbed areas. With the implementation of BMPs contained in the SWPPP and DESCP, such as straw bales, silt fences, and limiting exposed areas, the impacts of soil erosion during construction should be less than significant. Site grading will be balanced on site; there will be no import or export of fill material. The Project is not located on farmland or in areas where agricultural protection legislation is applicable; therefore, there will be no impacts to agricultural soils at the Project site.

Due to the project's large scale, numerous physical variables exist that could affect the soil resources within the site boundaries. These variables are associated with various site conditions (erodibility) and potential environmental considerations (precipitation). In order to address possible outcomes given the various site conditions and possible environmental factors, the applicant has carried out mathematical calculations and probabilistic modeling to estimate anticipated potential impacts. While modeling and calculations can be used in an attempt to estimate future effects from a variety of environmental considerations, and they provide a basis for structural design parameters, these methods are based on assumptions and projections that are imprecise and untested in this environment. Should these assumptions and calculations be inaccurate, the consequences of flash flood damage or modified sedimentation and erosion rates may be significant. Staff has proposed conditions of certification **SOIL& WATER-1, -2,** and **-3** that would mitigate these potential impacts.

Water Supply and Use

Staff evaluated the potential of the project's proposed water use to cause a substantial depletion or degradation of groundwater resources, including impacts on existing beneficial uses. Staff considered compliance with the LORS and policies presented in **Soil & Water Table 1** and whether there would be a significant California Environmental Quality Act (CEQA) impact.

The water required for construction will be obtained from a groundwater well located in Cadiz, CA (**Soil & Water Figure 5**). The groundwater pumped from the well will be placed into rail tankers and hauled to the project site. At the project site, the water will be conveyed to a groundwater storage tank located at the Water Treatment Facility within the Main Services Complex.

Construction water use, summarized in **Soil & Water Table 4** will average approximately 150,000 gallons per day, with a total annual use of approximately 167AFY. During the 2nd and 3rd months of construction, and again in the13th month of construction, peak water needs will be approximately 450,000 gallons per day. The total water use for complete project construction is estimated to be approximately 556 AF.

Basin Balance

Very little development has occurred in the Cadiz Valley Groundwater Basin. As such, there are limited data available for the site vicinity regarding aquifer characteristics in the groundwater basin. California Department of Water Resources (DWR) Bulletin 118 for the Cadiz Valley Groundwater Basin indicates that the total storage capacity of the basin is approximately 4.3 million AF with an estimated natural recharge of approximately 800 AFY. DWR estimates that in 1952, extractions within Cadiz Valley Groundwater

Basin were approximately 1 AFY. The applicant indicates that studies conducted within Cadiz Valley show a recharge in the area at 2,550 to 11,200 AFY. Studies by Bredhoft (2001) suggests recharge to the Cadiz and Fenner Valleys is approximately 5,000 AFY. Absent unusual circumstances, staff considers impacts to the basin balance to be significant if project pumping exceeds net average recharge to the basin. Since water use associated with project construction is less than annual average recharge, staff believes project pumping will not have significant impacts on aquifer storage volumes in the Cadiz Valley.

However, given the wide range and uncertainty in the estimates of recharge to the Cadiz Valley groundwater basin, it is possible that the current agricultural pumping of 5,000 AFY could be greater than basin recharge and other inflows and could result in long term declines in basin storage. Staff believes the applicant should be required to comply with Condition of Certification **SOIL&WATER-4** which would ensure the project supply would be limited to the maximum needed for project construction and is consistent with the amount analyzed. Staff also proposes Condition of Certification **SOIL&WATER-8** which would require the applicant to comply with the County of San Bernardino's Desert Groundwater Management Ordinance and implement a monitoring plan that would characterize baseline water levels in the project vicinity, characterize aquifer materials, integrate water level measurement with any existing monitoring network, and provide for analysis of the project effects on water levels in the area. Staff proposes to coordinate with the County of San Bernardino to evaluate changes due to project pumping and the current agricultural uses of about 5,000 AFY.

Groundwater Levels

In January 2010, the applicant conducted aquifer testing in the proposed Cadiz BNSF water supply well. The aquifer testing consisted of a short term stress test, followed by a 24-hour stepped rate pumping test and well recovery monitoring. The data collected during the tests were used to assess hydraulic properties of the well, short term specific capacity, transmissivity, long term drawdown effects and long term pumping zone-of-influence determination.

During the 24-hour stepped rate pumping test, approximately 187,000 gallons of water were pumped from the well. Near the end of the pumping period, drawdown of groundwater in the well was measured at approximately 3.2 feet. Within 2 ½ hours of cessation of the pumping test, groundwater recovered in the well to within .24 feet (2.88 inches) of the pre-pumping water level. This relatively minor drawdown provides a qualitative measure of the well's ability to provide an adequate water supply at the rates planned for project construction and operation. An average specific capacity of 51.3 gpm/ft was estimated based on the results of the pump test.

The applicant used the widely accepted AQTESOLV program and applied the Cooper and Jacob (1946) and Theis (1935) Recovery Test Methods to estimate aquifer transmissivity. Transmissivity is a measure of an aquifer's ability to transmit water, and is an important parameter used to evaluate potential drawdown from pumping a groundwater well. Using these methods a transmissivity of 170,000 gallons per day per foot (gpd/ft) was calculated. Using published relationships (USBR 1985) between specific capacity and transmissivity, Staff believes the value of transmissivity estimated using these methods is reasonable when compared to the specific capacity estimated from the short term pump test.

The applicant provided drawdown estimates of groundwater in the project well using the modified Cooper-Jacob Method and the transmissivity value estimate above. The results of this analysis show the total projected drawdown at the end of the initial 2-year construction phase would be approximately 2.5 feet when maximum pumping would occur. Drawdown would stabilize at 0.65 after 5 years of project operation pumping. Staff believes the stabilized drawdown estimate is reasonable and suggests there would be minimal affect on water levels in the basin. The applicant did provide an analysis of drawdown effects due to project pumping but they used the California Drinking Water Source Assessment and Protection Program (1999) ‘Calculated Fixed Radius’ methodology. This methodology is designed to calculate the zone of contribution to a pumping well under a given pumping scenario rather than estimate the drawdown at a given distance from a pumping well. This method is used to identify an area around a well that should be protected from contamination and protect public health and safety. Given the minimal drawdown at the pumping well discussed above, however, application of this simple methodology is useful in understanding the magnitude of the project pumping effects at distance. Estimates using this methodology show that the zone of contribution to the project pumping well would be within a radius of 540 feet after 20 years of pumping. The closest well to the site production well is 1 mile south. Staff believes that given the limited zone of contribution and minimal drawdown in the pumping well, there would be no significant impacts to wells in the Cadiz Valley due to project pumping during construction.

Staff believes the applicant should be required to comply with Condition of Certification **SOIL&WATER-4** which would ensure the project supply would be limited to the maximum needed for project construction and is consistent with the amount analyzed.

The well site is located in a relatively flat area, next to I-40 and the BNSF rail line approximately 2 miles away from the closest hills. Seeps and springs in the Cadiz BNSF well site vicinity are limited to granitic rock areas in the Granite and Old Woman mountains, shallow intrusive rock in the Providence Mountains, and volcanic sediments in the Clipper Mountains are located more than 10 miles from the proposed water supply well and are above the elevation of the Cadiz groundwater basin indicating they are not hydraulically connected and fed by shallow groundwater. Due to the lack of hydraulic connectivity, it does not appear that pumping from the Cadiz BNSF well during construction will have any effect on nearby springs or seeps. Therefore, no significant impacts to seeps or springs is expected. In addition, the depth to groundwater at the well is about 230 feet below ground surface which is also below the root zone depth of known sensitive plant species in the region. Given the depth to groundwater at the project supply well it is unlikely there is any plant or animal community that would be affected by the project pumping.

To ensure a reliable groundwater supply can be provided by a well, the maximum recommended well pumping rate should generally not result in long-term drawdown that exceeds 20% of the aquifer thickness. Based on the well construction details (length of perforated well screen used as aquifer thickness), effective porosity chosen as 0.2, and the data collected during the aquifer testing, the applicant determined that short term pumping operations for peak demand could be as high as 2,000 gpm without causing drawdown to exceed 20% of the aquifer thickness (in this case, 39 feet). Anticipated peak demand for site construction is estimated to be 100 gpm, well below the 2,000 gpm discussed above. Additionally, peak short term needs for facility operations are expected to approach 45 gpm, which would create groundwater drawdown significantly less than the anticipated peak construction drawdown. These results suggest the proposed well can provide a reliable long term supply of water for project construction and operation. To ensure an adequate supply can be delivered for project construction, staff recommends the applicant be required to comply with Condition of Certification **SOIL & WATER – 5**, by executing a Water Purchase Agreement with the water purveyor (BNSF) for a 30- to 35-year supply of fresh water for the Calico Solar Project**.**

Potable water during construction will be obtained off site and supplied to the site via truck and stored in above ground tanks. The applicant indicates the potable water will be replenished every two to three days (SES 2008a). No significant impacts are expected due to the use of this limited imported supply.

Wastewater

Improper handling or containment of construction wastewater could cause a broad dispersion of contaminants to soil or groundwater. Discharge of any non-hazardous construction-generated wastewater would require compliance with discharge regulations. Sources of wastewater would include equipment wash water and piping and vessel hydrostatic test water. Equipment wash water would be transported to an appropriate treatment facility. Hydrostatic test water would be reused to the extent possible and, pending analytical results of the water, would be discharged to land or trucked offsite to an appropriate treatment and disposal facility in accordance with the SWRCB Water Quality Order No. 2003-003-DWQ as a discharge to land with a low threat to groundwater and the requirements that are currently under development with the Lahontan RWQCB that will be included in Condition of Certification **SOIL&WATER-2**. Compliance with the requirements would reduce the potential impacts from release of waste water to less than significant. The applicant has not provided information necessary to complete development of requirements. Once the applicant provides this information, staff can complete development of requirements that will be included in Condition of Certification **SOIL&WATER-2**.

Operation Impacts and Mitigation

Operation of the proposed project could lead to accelerated soil erosion and increased storm water runoff. The project's operation could also lead to potential water quality and water supply impacts. Soils may be potentially impacted through erosion or the release of hazardous materials used in the operation of the proposed project. Storm water runoff from the project could result in potential impacts if increased runoff flow rates and volumes discharged from the project increase erosion of the soil and increase down stream flooding. Water quality could be impacted by discharge of eroded sediments from the project or discharge of hazardous materials released during operation. Water supply used for dust suppression, SunCatcher mirror washing, and fire protection could lead to potential quantity or quality impacts to groundwater resources. Potential impacts to water quality and water supply and the potential acceleration of soil erosion and increased storm water runoff related to the operation of the project, including the applicant's proposed mitigation measures and staff's proposed mitigation measures, are discussed below.

Soil Erosion and Storm Water Control

Staff evaluated the potential impacts to soil resources caused by operation of the facility that could result in erosion and downstream transportation of soils and the potential contamination of soils and groundwater. There are extensive regulatory programs in effect that are designed to prevent or minimize these types of impacts. These programs are effective, and absent unusual circumstances, an applicant's ability to identify and implement program-approved BMPs to prevent erosion or contamination is sufficient to ensure that these impacts would be less than significant. In addition, soils would be protected by the development and implementation a Drainage, Erosion and Sedimentation Control Plan (DESCP).

Although these programs and BMPs are generally effective on most projects, staff considers that the proposed project does constitute an unusual circumstance. Compared to other projects previously constructed on active alluvial fans, the proposed project is of a very large scale.

The proposed project would be located on a series of undeveloped alluvial fans. Currently, the storm water runoff either percolates into the soil or is conveyed as sheet flow across the fans or through the alluvial fan wash channels. Several project features would contribute to the potential for increased water erosion, including earth displacement, construction of access roads and project infrastructure, the long duration for construction, and changes to the properties of the soil. Construction of the proposed project would change natural drainages, remove natural vegetation and soil structure, and add impervious areas to the site, all of which could cause an increase in storm water runoff.

To support the final design parameters, the applicant analyzed the hydrology of the project area and calculated anticipated storm flows. The study area's watershed is approximately 80 square miles. **Soil & Water Table 7** provides a summary of anticipated precipitation and storm flow (i.e., runoff) rates.

Soil & Water Table 7
Calico Solar Hydrology Summary

Storm Frequency	6-hour Storm Rainfall (inches)	24-hour Storm Rainfall (inches)	6-hour Storm Runoff (cubic feet per second)	24-hour Storm Runoff (cubic feet per second)
2-year	0.70	0.94	0	0
5-year	1.06	1.41	0	0
10-year	1.33	1.73	1,458	4,145
25-year	1.70	2.15	3,904	7,939
50-year	1.99	2.47	6,435	11,150
100-year	2.31	2.80	22,049	28,772

Source: SES 2009i, Applicants Responses to CEC & BLM Data Requests (Surface Water), pg. A-1.

Runoff from these sub-watersheds was modeled by the applicant using the Army Corps of Engineers (USACOE2009) HEC-1 computer hydrology model.

Storm water flow volume and velocity is affected by several parameters, such as surface infiltration rates and the roughness of the flow surface. Construction, operation, and decommissioning of the proposed project may modify the infiltration rate through several processes, including earthmoving, compaction, and use of dust suppressants.

Water quality could also be impacted if the storm water drainage pattern concentrates runoff in areas that are not properly designed or protected with BMPs or causes increased erosion and sediment discharge offsite. Project components that could alter or concentrate existing drainage patterns could include the installation of linear fences, access roads, buildings, SunCatchers, and associated infrastructure.

With concentrated flows, scour may transport sediment long distances. Scour may occur under sheetflow conditions due to water depths, velocities, and soil parameters. Scour of existing or future channelized flow paths can meander and move during large flow events, which is common on alluvial fans. The proposed project includes a total of 35,000 solar dishes (i.e., SunCatchers) supported by a single metal fin-pipe foundation hydraulically driven into the ground. Migration of channels and local scour caused by storm water flows could remove sediment supporting individual poles and cause them to fall to the ground. Once on the ground during a storm event, the broken glass associated with the mirrors could further break and be transported downstream. Also, the SunCatchers structure itself and the associated wiring, could be transported downstream. Although the security fence located on the downstream side of the proposed project area could stop larger pieces from leaving the property, it would not stop small glass fragments. Also, the fence itself could be threatened by storm water flows and could not guarantee the onsite capture of all damaged materials.

Condition of Certification **SOIL&WATER-3** requires the SunCatchers to withstand this potential scour. In addition, this condition requires the applicant to develop a Storm Water Damage Monitoring and Response Plan, which would include a plan to cleanup and mitigate damaged SunCatchers. The applicant proposes to construct large stormwater debris capture basins along the northern property boundary. These basins will be of sufficient size to completely retain flood flows resulting from a 100-year flood. Following significant storms, retained water would be released into the existing channels in a controlled and metered manner at a rate that will not cause damage to SunCatcher pole foundations located within the channels. With this controlled release of captured stormwater, staff believes the impact to erosion of the SunCatcher foundations will be less than significant.

Staff believes the effects of erosion and storm water flow onto and off the proposed project can be mitigated through implementation of Conditions of Certification **SOIL&WATER-1**, **-2**, and **-3**. **SOIL&WATER-1** would require the project applicant to develop a DESCP to ensure protection of water quality and soil resources. **SOIL&WATER-2** would require the applicant to develop an Industrial SWPPP that meets the requirements for discharges of storm water. Condition of Certification **SOIL&WATER-3** would require the applicant to develop a Storm Water Damage

Monitoring and Response Plan to monitor the SunCatchers and mitigate potential impacts from SunCatchers damaged during storm events.

In order to address possible outcomes given the various site conditions and possible environmental factors, the applicant has carried out mathematical calculations and probabilistic modeling to estimate anticipated potential impacts. While modeling and calculations can be used in an attempt to estimate future effects from a variety of environmental considerations, and they provide a basis for structural design parameters, these methods are based on assumptions and projections that are imprecise and untested in this environment. Should these assumptions and calculations be inaccurate, the consequences of flash flood damage or modified sedimentation and erosion rates may be significant. The Project is not located on farmland or in areas where agricultural protection legislation is applicable; therefore, there will be no impacts to agricultural soils at the Project site. Staff has proposed conditions of certification **SOIL & WATER-1, -2,** and **-3** that would mitigate these potential impacts.

Project Water Supply

The project's operational water demand is estimated to be approximately 20 AFY. The applicant has proposed to pump groundwater from a well owned by BNSF and located in Cadiz, California for all plant operational needs. Cadiz is approximately 64 miles southeast of the project site. The water will be loaded into railroad tank cars and transported by rail to the site.

Basin Balance

Very little development has occurred in the Cadiz Valley Groundwater Basin. As such, there are limited data available for the site vicinity regarding aquifer characteristics in the groundwater basin. California Department of Water Resources (DWR) Bulletin 118 for the Cadiz Valley Groundwater Basin indicates that the total storage capacity of the basin is approximately 4.3 million AF with an estimated natural recharge of approximately 800 AFY. DWR estimates that in 1952, extractions within Cadiz Valley Groundwater Basin were approximately 1 AFY. The applicant indicates that studies conducted within Cadiz Valley show a recharge in the area at 2,550 to 11,200 AFY. Studies by Bredhoft (2001) suggest recharge to the Cadiz and Fenner Valleys is approximately 5,000 AFY. Absent unusual circumstances, staff considers impacts to the basin balance to be significant if project pumping exceeds net average recharge to the basin. Since water use associated with project operation is less than annual average recharge, staff believes project pumping will not have significant impacts on aquifer storage volumes in the Cadiz Valley.

However, given the wide range and uncertainty in the estimates of recharge to the Cadiz Valley groundwater basin, it is possible that the current agricultural pumping of 5,000 AFY could be greater than basin recharge and other inflows and could result in long term declines in basin storage. Staff believes the applicant should be required to comply with Condition of Certification **SOIL&WATER-4** which would ensure the project supply would be limited to the maximum needed for project construction and operation. Staff also proposes Condition of Certification **SOIL&WATER-8** which would require the applicant to comply with the County of San Bernardino's Desert Groundwater Management Ordinance and implement a monitoring plan that would characterize baseline water levels in the project vicinity, characterize aquifer materials, integrate water level measurement with any existing monitoring network, and provide for analysis of the project effects on water levels in the area. Staff proposes to coordinate with the County of San Bernardino to evaluate changes due to project pumping and the current agricultural uses of about 5,000 AFY.

Groundwater Levels

In January 2010, the applicant conducted aquifer testing in the proposed Cadiz BNSF water supply well. The aquifer testing consisted of a short term stress test, followed by a 24-hour stepped rate pumping test and well recovery monitoring. The data collected during the tests were used to assess hydraulic properties of the well, short term specific capacity, transmissivity, long term drawdown effects and long term pumping zone-of-influence determination.

During the 24-hour stepped rate pumping test, approximately 187,000 gallons of water were pumped from the well. Near the end of the pumping period, drawdown of groundwater in the well was measured at approximately 3.2 feet. Within 2½ hours of cessation of the pumping test, groundwater recovered in the well to within 0.24 feet (2.88 inches) of the pre-pumping water level. This relatively minor drawdown provides a qualitative measure of the well’s ability to provide an adequate water supply at the rates planned for project construction and operation. An average specific capacity of 51.3 gpm/ft was estimated based on the results of the pump test.

The applicant used the widely accepted AQTESOLV program and applied the Cooper and Jacob (1946) and Theis (1935) Recovery Test Methods to estimate aquifer transmissivity. Transmissivity is a measure of an aquifer’s ability to transmit water, and is an important parameter used to evaluate potential drawdown from pumping a groundwater well. Using these methods a transmissivity of 170,000 gallons per day per foot (gpd/ft) was calculated. Using published relationships (USBR 1985) between specific capacity and transmissivity, Staff believes the value of transmissivity estimated using these methods is reasonable when compared to the specific capacity estimated from the short term pump test.

The applicant provided drawdown estimates of groundwater in the project well using the modified Cooper-Jacob Method and the transmissivity value estimate above. The results of this analysis show the total projected drawdown at the end of the 2-year construction phase would be approximately 2.5 feet and would stabilize at 0.65 after 5 years of project pumping. Staff believes the stabilized drawdown estimate is reasonable and suggests there would be minimal affect on water levels in the basin. The applicant did provide an analysis of drawdown effects due to project pumping but they used the California Drinking Water Source Assessment and Protection Program (1999) ‘Calculated Fixed Radius’ methodology. This methodology is designed to calculate the zone of contribution to a pumping well under a given pumping scenario rather than estimate the drawdown at a given distance from a pumping well. This method is used to identify an area around a well that should be protected from contamination and protect public health and safety. Given the minimal drawdown at the pumping well discussed above, however, application of this simple methodology is useful in understanding the magnitude of the project pumping effects at distance. Estimates using this methodology show that the zone of contribution to the project pumping well would be within a radius of 540 feet after 20 years of pumping. The closest well to the site production well is one-half mile (2,640 feet) away. Staff believes that given the limited zone of contribution and minimal drawdown in the pumping well, there would be no significant impacts to wells in the Cadiz Valley due to project pumping.

As shown in **Soil & Water Table 5**, the daily maximum water use for power plant operation is estimated to be 20.62 gallons per minute. Average annual use of water for power plant operation is estimated to be 20.14 AF. To ensure the proposed project does not consume significantly more water than the volume analyzed, yet provide a sufficient volume for unforeseen circumstances, staff proposes Condition of Certification **SOIL&WATER- 4** to limit the amount of groundwater the project could use annually during operations to 20 AF.

The well site is located in a relatively flat area, next to I-40 and the BNSF rail line approximately 2 miles away from the closest hills. Seeps and springs in the Cadiz BNSF well site vicinity are limited to granitic rock areas in the Granite and Old Woman mountains, shallow intrusive rock in the Providence Mountains, and volcanic sediments in the Clipper Mountains are located more than 10 miles from the proposed water supply well and are above the elevation of the Cadiz groundwater basin indicating they are not hydraulically connected and fed by shallow groundwater. Due to the lack of hydraulic connectivity, it does not appear that pumping from the Cadiz BNSF well will have any effect on nearby springs or seeps. Therefore, no significant impacts to seeps or springs is expected. In addition, the depth to groundwater at the well is about 230 feet below ground surface which is also below the root zone depth of known sensitive plant species in the region. Given the depth to groundwater at the project supply well it is unlikely there is any plant or animal community that would be affected by the project pumping.

To ensure a reliable groundwater supply can be provided by a well, the maximum recommended well pumping rate should generally not result in long-term drawdown that exceeds 20% of the aquifer thickness. Based on the well construction details (length of perforated well screen used as aquifer thickness), effective porosity chosen as 0.2, and the data collected during the aquifer testing, the applicant determined that short term pumping operations for peak demand could be as high as 2,000 gpm without causing drawdown to exceed 20% of the aquifer thickness (in this case, 39 feet). Anticipated peak demand for site construction is estimated to be 100 gpm, well below the 2,000 gpm discussed above. Additionally, peak short term needs for facility operations are expected to approach 45 gpm, which would create groundwater drawdown significantly less than the anticipated peak construction drawdown. These results suggest the proposed well can provide a reliable long term supply of water for project construction and operation. To ensure an adequate supply can be delivered for project operation, staff recommends the applicant be required to comply with Condition of Certification **SOIL & WATER – 5**, by executing a Water Purchase Agreement with the water purveyor (BNSF) for a 30- to 35-year supply of fresh water for the Calico Solar Project**.**

Groundwater Quality

Groundwater quality information is sparse in the project supply well vicinity. The Colorado River Regional Water Quality Control Board Basin Plan (2006) indicates that groundwater within the Cadiz Hydrologic Unit has municipal, domestic and industrial beneficial uses.

Within the Cadiz Valley Groundwater Basin, groundwater flows toward both Bristol and Cadiz dry lakes. Bristol Dry Lake is approximately 5½ miles southwest of the Cadiz BNSF well and Cadiz Dry Lake is approximately 11 miles south-southeast from the well. As with most dry lakes in the Mojave Desert, groundwater is saline in the immediate vicinity of the dry lakes. Salt is being mined on the west shore of Bristol dry lake in an area approximately 10 miles southwest of the proposed water supply well and is also mined in the area south of Cadiz Dry Lake.

By providing a measure of water salinity, TDS is a primary indicator of the natural quality of groundwater and is a measure of acceptance for the use of groundwater as a drinking water source. Water with TDS concentrations greater than 2,000 mg/l is generally considered undrinkable without significant treatment. In California, the recommended Secondary MCL or 'Consumer Acceptance Contaminant Level' for TDS is 500 mg/l, and upper and short term ranges can be 1,000 and 1,500 mg/l, respectively.

Thompson (1929) Indicated the groundwater basin largely holds brackish or saline groundwater, except in the vicinity of Cadiz and Archer and southwest of Altura. Historical information on water quality of the Cadiz BNSF well indicate that groundwater quality is good and Total Dissolved Solids (TDS) concentrations have ranged between approximately 250 mg/L to 359 mg/L (DWR, 1967).

Water quality can be impacted by migration of low quality or contaminated water towards pumping wells and by sustained pumping of the groundwater basin. The Cadiz Company has been pumping groundwater to irrigate agriculture fields on their property located approximately 1 to mile south of the project supply well. According to Bredhoeft 2001, the Cadiz Company has been pumping approximately 5,000 AFY of groundwater "…for more than a decade and appears to have little or no significant adverse impacts."

Use of the Cadiz BNSF well as the project supply well is not anticipated to affect water quality of the basin because pumping at the rates needed will result in limited drawdown and the resulting zone of influence would be relatively small. Therefore, staff believes there would be no water quality impacts to other users in the groundwater basin.

Wastewater

The Cadiz BNSF well groundwater is expected to contain TDS concentrations of approximately 350 mg/L. The applicant intends to treat the groundwater to a quality suitable for mirror washing. The applicant considers water with a TDS concentration of 20 mg/L to be suitable for mirror washing. Treating the groundwater using demineralizer equipment to attain a concentration suitable for mirror washing will create a wastewater stream that will contain four to five times as much TDS as the source water.

The applicant estimates that the treatment wastewater will contain approximately 3,600 mg/L TDS. The applicant proposes to discharge the wastewater to one of two concrete-lined evaporation ponds, or equivalent. Each pond will be sized to contain 1 year of discharge flow or approximately 3 million gallons. A minimum of 1 year is expected to be required for the wastewater to undergo the evaporation process. After the first year, the second pond will be in operation while the first is undergoing evaporation. The two ponds will alternate their functions on an annual basis. After the brine has gone through the evaporation process, the solids that settle at the bottom of the evaporation pond will be tested by the applicant and disposed of in an appropriate non-hazardous waste disposal facility. The solids will be scheduled for removal during the dry summer months.

The applicant proposes two separate wastewater collection systems for the proposed project. The first system would collect all wastewater generated from operation of the plant equipment and recycle and reuse that water to the extent practicable. A wastewater collection system would return water from all general plant drains back to the raw water storage tank. Water that may contain oil or grease would first be routed to an oil/water separator before going to the raw water storage tank. Prior to transport and disposal of any facility operation wastewaters that are not suitable for treatment and reuse onsite, the applicant would test and classify the stored wastewater to determine proper management and disposal requirements. Staff recommends that the collection and recycling of this wastewater be managed in accordance with applicable BMP’s and LORS.

The second system would collect and treat all sanitary wastewater from sinks, toilets, and other sanitary facilities. Because there are no sanitary sewer connections, the sanitary wastewater would be processed through a septic system and discharged to a leach field. Solids would be periodically removed by a professional service. The maximum average daily wastewater flow to the leach field is expected to be 5,500 gallons (SES 2008a).

No significant water or soil related impacts are expected to occur due to wastewater if the project owner complies with proposed Conditions of Certification **SOIL&WATER-2** and -6. **SOIL&WATER-2** would provide requirements for discharge of wastewater and **SOIL&WATER-6** provides the requirements for the installation of the proposed septic tank and leach field. The applicant has not provided information necessary to complete development of requirements for discharges of brine waters to evaporation ponds or sanitary septic systems. Once the applicant provides this information, staff can complete development of requirements that will be included in Condition of Certification **SOIL&WATER-2**.

Decommissioning

The removal of the Project from service, or decommissioning, may range from “mothballing” to the removal of equipment and appurtenant facilities, depending on conditions at the time. The applicant proposes to prepare a decommissioning plan which will be submitted to the Energy Commission and BLM for approval before decommissioning. In general, the decommissioning plan will attempt to maximize the recycling of project components including selling unused chemicals back to the suppliers or other purchasers or users, draining and shutting down of equipment containing chemicals, and collection and proper disposal of hazardous and nonhazardous wastes.

Decommissioning activities will produce impacts similar to the construction impacts described above, but likely to a lesser extent. Long-term impacts after decommissioning could be substantial, particularly those related to erosion by water and wind, unless the site is restored to a condition similar to the existing condition, or a post-decommissioning maintenance plan is provided to prevent these impacts. Condition of Certification **SOIL&WATER-7** would ensure that decommissioning impacts would be minimized to a level not significant.

C.7.4.3 CEQA LEVEL OF SIGNIFICANCE

Absent any unusual circumstances, staff considers project compliance with LORS and staff's conditions of certification to be sufficient to ensure that no significant hydrology, water use, and water quality impacts would occur. This determination is based on the following:

- **Whether the project would violate water quality standards or waste discharge requirements:** Conditions of Certification **SOIL&WATER-1** (DESCP); **SOIL&WATER-2** (Waste Discharge Requirements); **SOIL&WATER-3** (Storm Water Damage Monitoring and Response Plan) and **SOIL&WATER-6** (Septic System and Leach Field Requirements) will ensure no violation of water quality standards or waste discharge requirements. The applicant has not provided information necessary to complete development of requirements for discharges of brine waters to evaporation ponds, dredge and fill in waters of the state, or sanitary septic systems. Once the applicant provides this information staff can complete development of requirements that will be included in Condition of Certification **SOIL&WATER-2**.
- **Whether the project substantially depletes groundwater supplies or interferes substantially with groundwater recharge such that there is a net deficit in aquifer volume:** The project will not use site groundwater. Minor amounts of groundwater will be obtained from Cadiz Valley. A significant volume of groundwater remains in storage in Cadiz Valley and project use will not significantly impact that storage. Recharge in the Lavic Valley Basin primarily occurs along mountain front and alluvial fan margins. Site grading and disturbance will not result in significant impacts to recharge potential of the Lavic Valley groundwater basin. No impact to groundwater supply or recharge will occur.
- **Whether the project substantially alters existing site or area drainage patterns, including the alteration of stream or river courses, or substantially increases the rate or amount of surface runoff in a manner that results in on- or off-site flooding or substantial erosion or siltation:** Conditions of Certification **SOIL&WATER-1** (DESCP); **SOIL&WATER-2** (Waste Discharge Requirements); **SOIL&WATER-3** (Stormwater Damage Monitoring and Response Plan) will ensure no adverse alteration of drainage patterns. The applicant has not provided information necessary to complete development of requirements for discharges of dredge and fill in waters of the state. Once the applicant provides this information staff can complete development of requirements that will be included in Condition of Certification **SOIL&WATER-2**.
- **Whether the project would create or contribute runoff water that exceeds existing or planned storm water-drainage system capacity or provides substantial additional sources of polluted runoff:** Compliance with LORS, will

insure no adverse impacts to waters of the U.S. Conditions of Certification **SOIL&WATER-1** (DESCP); **SOIL&WATER-2** (Waste Discharge Requirements); **SOIL&WATER-3** (Stormwater Damage Monitoring and Response Plan) will ensure that the project not create or contribute runoff water that exceeds existing or planned storm water-drainage system capacity or provides substantial additional sources of polluted runoff. The applicant has not provided information necessary to complete development of requirements for discharges. Once the applicant provides this information staff can complete development of requirements that will be included in Condition of Certification **SOIL&WATER-2**.

- **Whether the project would lower groundwater levels such that protected species or habitats are affected:** The project will use minor volumes of groundwater. Depth to groundwater in the vicinity of the proposed water supply well is beyond the reach of phreatophitic vegetation and no other species or habitats utilize the resource. No adverse groundwater quantity impacts are expected.
- **Whether the project would substantially degrade surface water or groundwater quality:** Conditions of Certification **SOIL&WATER-1** (DESCP); **SOIL&WATER-2** (Waste Discharge Requirements); **SOIL&WATER-3** (Storm Water Damage Monitoring and Response Plan) and **SOIL&WATER-6** (Septic System and Leach Field Requirements) will ensure no degradation of surface water or groundwater quality. The applicant has not provided information necessary to complete development of requirements for discharges of brine waters to evaporation ponds, dredge and fill in waters of the state, or sanitary septic systems. Once the applicant provides this information staff can complete development of requirements that will be included in Condition of Certification **SOIL&WATER-2**.
- **Whether the project would place structures within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map:** The project will place a substantial number of structures in the floodplain in the form of SunCatchers. No structural buildings are proposed to be located in areas susceptible to flooding resulting from a 100-year storm. Conditions of Certification **SOIL&WATER-3** (Stormwater Damage Monitoring and Response Plan) will ensure that structures within the floodplain are protected and that redirected flows are designed such that they not cause adverse impacts. No adverse impacts to site structures due to flooding are expected.
- **Whether the project would expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam:** The Project's retention basins are designed to intercept and temporarily retain flows as large as those resulting from a 100-year storm. The basins are proposed to be excavated into the ground rather than constructed above ground using levees or dams. No dams or levees exist upgradient of the Project. Therefore, the risk of loss, injury or death resulting from flooding is less than significant.

C.7.5 REDUCED ACREAGE ALTERNATIVE

The Reduced Acreage Alternative would essentially be a 275 MW solar facility located within the boundaries of Phase 2 of the proposed 850 MW project. This alternative's boundaries and the revised locations of the transmission line, substation, laydown, and control facilities are shown in **Alternatives Figure 1**.

C.7.5.1 SETTING AND EXISTING CONDITIONS

The Reduced Acreage Alternative would consist of 11,000 SunCatchers (rather than the proposed 34,000) with a net generating capacity of approximately 275 MW (rather than the proposed 850 MW) occupying approximately 2,600 acres of land (rather than the proposed 8,230). This alternative would retain 31% of the proposed SunCatchers and would affect 33% of the land of the originally proposed project.

The boundaries of the Reduced Acreage Alternative are shown in **Alternatives Figure 1**. This area was designed, in the proposed project configuration, to generate 350 MW, but has been reduced in capacity to the amount that could be carried by existing transmission systems. As a result, the components of the Reduced Acreage Alternative could be configured on the site to avoid sensitive cultural and biological resources, as well as desert washes.

Similar to the proposed project, the Reduced Acreage Alternative would transmit power to the grid through the Southern California Edison (SCE) Pisgah Substation and would require infrastructure including water storage tanks, transmission line, road access, main services complex, and substation (SES 2008a). The main services complex for the Reduced Acreage Alternative would be located at the location proposed for the satellite services complex in the proposed project. For the purposes of the Reduced Acreage Alternative, it is assumed that the BNSF Cadiz well would supply water for the project. The water would be supplied as proposed for the Calico Solar Project. The substation and transmission line would be located north of the BNSF railroad line.

As stated above, the Reduced Acreage Alternative is evaluated in this SA/DEIS because it would substantially reduce the impacts of the project. Additionally, the Reduced Acreage Alternative would allow the applicant to demonstrate the success of the Stirling engine technology and construction techniques, while minimizing impacts to the desert environment.

C.7.5.2 ASSESSMENT OF IMPACTS AND DISCUSSION OF MITIGATION

Potential impacts identified for both the construction and operation phases of the project include impacts on soil erosion, sedimentation, flooding, water quality, and water supply. All of the potential impacts identified for the proposed project remain with the Reduced Acreage Alternative. However, due to the alternative's reduced physical size and reduction in number of SunCatchers, these potential impacts are proportionately reduced. The location of detention basins in Sections 32 and 33, Township 9 North, Range 6 East would be relocated adjacent to the northern boundary of the Reduced Acreage project area in Sections 5 and 6, Township 8 North, Range 6 East. Relocating these basins would require that they be redesigned and sized to handle increased watershed areas and different flow paths as appropriate.

C.7.5.3 CEQA LEVEL OF SIGNIFICANCE

There would be no change in the CEQA Level of Significance of impacts between the proposed project and the Reduced Acreage alternative.

C.7.6 AVOIDANCE OF DONATED AND ACQUIRED LANDS ALTERNATIVE

The Avoidance of Donated and Acquired Lands Alternative would be an approximately 720 MW solar facility located within the boundaries of the proposed 850 MW project. This alternative, the transmission line, substation, laydown, and control facilities are shown in **Alternatives Figure 2**.

C.7.6.1 SETTING AND EXISTING CONDITIONS

The Avoidance of Donated and Acquired Lands Alternative would be an approximately 720 MW solar facility located within the boundaries of the proposed project. This alternative is analyzed because (1) it eliminates about 15% of the proposed project area so all impacts are reduced, and (2) it would not require use of any lands that were donated to BLM or acquired by BLM through the Land and Water Conservation Fund program. This alternative would be consistent with the May 27, 2009 BLM Interim Policy Memorandum (CA-2009-020) on donated and acquired lands.

The Avoidance of Donated and Acquired Lands Alternative would contain approximately 28,800 SunCatchers with a net generating capacity of approximately 720 MW occupying approximately 7,050 acres of land. This alternative would retain 85% of the proposed SunCatchers and would affect 85% of the land of the proposed 850 MW project.

The boundaries of the Avoidance of Donated and Acquired Lands Alternative are shown in **Alternatives Figure 2**. The easternmost parcel of the alternative is bordered by LWCF acquired lands to the north, south, and west. Because this parcel could not be reached via project lands, access to this section would be limited to use of the existing transmission line access road that forms the eastern boundary of the parcel, therefore avoiding any new direct impacts to LWCF lands.

The Avoidance of Donated and Acquired Lands Alternative would transmit power to the grid through the SCE Pisgah Substation and would require infrastructure including water storage tanks, transmission line, road access, main services complex, and substation. Because the Avoidance of Donated and Acquired Lands Alternative would generate approximately 720 MW of power, it would require a 65-mile upgrade to the SCE Pisgah-Lugo transmission line. Note that the impacts of this transmission line upgrade are analyzed in Sections C and D of this SA/DEIS. The main services complex, primary water well, substation, and transmission line for the Avoidance of Donated and Acquired Lands Alternative would be at the same locations as for the proposed project.

C.7.6.2 ASSESSMENT OF IMPACTS AND DISCUSSION OF MITIGATION

The portion of the Avoidance of Donated and Acquired Lands Alternative in the northeastern corner of the originally proposed Calico Solar site occupies the area where flood intercept debris collection and flow detention basins were designed by the applicant to mitigate the 100-year flood impact to the site. Should the Avoidance of Donated and Acquired Lands Alternative be constructed, flood intercept debris collection and flow detention basins would need to be similarly designed and constructed downstream from the southern boundary of that donated parcel.

Another donated parcel is located near the center of the original site. Should the Avoidance of Donated and Acquired Lands Alternative be constructed, onsite drainage control structures will need to be redesigned to avoid that donated parcel, while maintaining site erosion/sedimentation control.

C.7.6.3 CEQA LEVEL OF SIGNIFICANCE

Provided the redesign of the flood control and erosion/sedimentation control structures meet the same standards as for the Calico Solar Project, no change to the CEQA Level of Significance of impacts would occur between the proposed project and the Avoidance of Donated and Acquired Lands Alternative.

C.7.7 NO PROJECT / NO ACTION ALTERNATIVE

There are three No Project / No Action Alternatives evaluated as follows:

No Project / No Action Alternative #1: No Action on the Calico Solar Project application and on CDCA land use plan amendment

Under this alternative, the proposed Calico Solar Project would not be approved by the Energy Commission and BLM and BLM would not amend the CDCA Plan. As a result, no solar energy project would be constructed on the project site and BLM would continue to manage the site consistent with the existing land use designation in the CDCA Land Use Plan of 1980, as amended.

The results of the No Project / No Action Alternative would be the following:

- The impacts of the proposed project would not occur. However, the land on which the project is proposed would become available to other uses that are consistent with BLM's land use plan, including another renewable energy project.
- The benefits of the proposed project in displacing fossil fuel fired generation and reducing associated greenhouse gas emissions from gas-fired generation would not occur. Both State and Federal law support the increased use of renewable power generation.

If the proposed project is not approved, renewable projects would likely be developed on other sites in San Bernardino County, the Mojave Desert, or in adjacent states as developers strive to provide renewable power that complies with utility requirements and State/Federal mandates. For example, there are dozens of other wind and solar projects that have applications pending with BLM in the California Desert District.

No Project / No Action Alternative #2: No Action on the Calico Solar Project and amend the CDCA land use plan to make the area available for future solar development

Under this alternative, the proposed Calico Solar Project would not be approved by the Energy Commission and BLM and BLM would amend the CDCA Land Use Plan of 1980, as amended, to allow for other solar projects on the site. As a result, it is possible that another solar energy project could be constructed on the project site.

Because the CDCA Plan would be amended, it is possible that the site would be developed with the same or a different solar technology. As a result, GHG emissions would result from the construction and operation of the solar technology and would likely be similar to the GHG emissions from the proposed project. Different solar technologies require different amounts of construction and operations maintenance; however, it is expected that all the technologies would provide the more significant benefit, like the proposed project, of displacing fossil fuel fired generation and reducing associated GHG emissions. As such, this No Project/No Action Alternative could result in GHG benefits similar to those of the proposed project.

No Project / No Action Alternative #3: No Action on the Calico Solar Project application and amend the CDCA land use plan to make the area unavailable for future solar development

Under this alternative, the proposed Calico Solar Project would not be approved by the Energy Commission and BLM and the BLM would amend the CDCA Plan to make the proposed site unavailable for future solar development. As a result, no solar energy project would be constructed on the project site and BLM would continue to manage the site consistent with the existing land use designation in the CDCA Land Use Plan of 1980, as amended.

Because the CDCA Plan would be amended to make the area unavailable for future solar development, it is expected that the site would continue to remain in its existing condition, with no new structures or facilities constructed or operated on the site. As a result, the greenhouse gas emissions from the site, including carbon uptake, is not expected to change noticeably from existing conditions and, as such, this No Project/No Action Alternative would not result in the GHG benefits from the proposed project. However, in the absence of this project, other renewable energy projects may be constructed to meet State and Federal mandates, and those projects would have similar impacts in other locations.

C.7.8 PROJECT-RELATED FUTURE ACTIONS - SOIL AND WATER RESOURCES

This section examines the potential impacts of future transmission line construction, line removal, substation expansion, and other upgrades that may be required by SCE as a result of the Calico Solar Project. The SCE upgrades are a reasonably foreseeable event if the Calico Solar Project is approved and constructed as proposed.

The SCE project will be fully evaluated in a future EIR/EIS prepared by the BLM and the California Public Utilities Commission. Because no application has yet been submitted and the SCE project is still in the planning stages, the level of impact analysis presented is based on available information. The purpose of this analysis is to inform the Energy Commission and BLM, interested parties, and the general public of the potential environmental and public health effects that may result these and the types of mitigation measure that may be required to reduce or eliminate significant adverse impacts.

The project components and construction activities associated with these future actions are described in detail in Section B.3 of this SA/DEIS. This analysis examines the construction and operational impacts of two upgrade scenarios

- The **275 MW Early Interconnection Option** would include upgrades to the existing SCE system that would result in 275 MW of additional latent system capacity. Under the 275 MW Early Interconnection option, Pisgah Substation would be expanded adjacent to the existing substation, one to two new 220 kV structures would be constructed to support the gen-tie from the Calico Solar Project into Pisgah Substation, and new telecommunication facilities would be installed within existing SCE ROWs.
- The **850 MW Full Build-Out Option** would include replacement of a 67-mile 220 kV SCE transmission line with a new 500 kV line, expansion of the Pisgah Substation at a new location and other telecommunication upgrades to allow for additional transmission system capacity to support the operation of the full Calico Solar Project.

C.7.8.1 ENVIRONMENTAL SETTING

The environmental setting described herein incorporates both the 275 MW Early Interconnection and the 850 MW Full Build-Out options. The setting for the 275 MW Early Interconnection upgrades at the Pisgah Substation and along the telecomm corridors is included within the larger setting for the project area under the 850 MW Full Build-Out option, which also includes the Lugo-Pisgah transmission corridor.

The SCE upgrades would be located within the Mojave River area in the southwestern part of the Mojave Desert, in San Bernardino County, California. Characteristic landforms in the Mojave Desert include broad alluvial fans, old dissected terraces, playas, the Mojave River and its flood plain, and scattered mountains. The Mojave River originates where the West Fork of the Mojave River joins the Deep Creek River. The river flows northward and then eastward past the City of Barstow. A flood plain 0.5 to 1.0-mile wide flanks the Mojave River along most of its course.

Natural resources in the Mojave River Area include soils, scenic resources, various mineral deposits, plants, and wildlife communities. Major minerals extracted in this area include gold, silver, feldspar, uranium, copper, iron, tungsten, turquoise, zeolite, barite, and clay. Limestone, sand, and gravel for cement and aggregate used for road construction are found at several locations throughout the area. The majority of the surface in the region is covered by Quaternary-age unconsolidated surficial deposits. These deposits are comprised primarily of alluvial, fluvial, lacustrine, and aeolian derived material (SES 2008a). Soils on the flood plains of the Mojave River are nearly level. Soils on mountainside areas are moderately steep to steep and gently sloping to moderately sloping in the valleys. Soils in the vicinity of the Proposed Project were formed from parent material of mixed alluvium and colluvium derived from a variety of rock types, primarily granite.

Land classified as grazing land comprises approximately 76% of the agricultural resources within the boundaries of the soil surveys of the Mojave River Area (SES 2008a). Prime Farmland, Farmland of Statewide Importance, Unique Farmland, and Farmland of Local Importance occur in the vicinity of the project and make up approximately 3% of the land in the project area (SES 2008a).

Soils Resources

The U.S. Department of Agriculture, Natural Resource Conservation Service has published soil surveys for the San Bernardino County Mojave River Area, the West Central Mojave Desert and Marine Corps Air Ground Combat Center Twentynine Palms located in the vicinity of the project area. Detailed reports of the soils present at the northeastern end of the project area near I-40 are not available (SES 2008a). Soils are grouped into mapping units that represent a unique natural landscape. Typically, a map unit consists of one or more major soils and the soils in any map unit may differ from place to place in slope, depth, drainage, and other characteristics that affect management. Because of the large project area, general map units have been grouped for broad interpretive purposes. The western half of the Lugo-Pisgah No. 2 500 kV transmission corridor area would be located within the San Bernardino County Mojave River Area. The San Bernardino County Mojave River Area is comprised of three groups of soil types. The central part of the Lugo-Pisgah No. 2 500 kV transmission line would be located within the West Central Mojave Desert soil survey. Two major soil groupings are identified within this area. Approximately 6 miles of the eastern portion of the Lugo-Pisgah No. 2 500 kV route would pass through the Marine Corp Ground Combat Center Twentynine Palms soil survey area. This area also contains three general types of soil groups (SES 2008a).

Agricultural Resources. The majority of the Lugo-Pisgah No. 2 500 kV transmission corridor is located on areas designated as Grazing Land. Approximately 3 miles near the center of the transmission corridor would pass through and adjacent to an area designated as Farmland of Statewide Importance of less than 1,000 acres. The nearest Prime Farmland and Farmland of Local Importance are approximately 1.6 miles and 1.1 miles south of the transmission line, respectively. Where the line reaches the eastern edge of the Mojave River, approximately 4.6 miles southeast of Hesperia, the transmission line passes adjacent to approximately 206 acres of an area designated as Farmland of Local Importance. The nearest Prime Farmland and Farmland of Statewide Importance are approximately 0.4 miles and 0.7 miles north, respectively (SES 2008a).

Water Resources

Surface Water Resources. Due to the arid nature of the region, surface water is very scarce in the project area. Streams originate high in the mountains ranges (Ord, Granite, Fry, Rodman, and Cady) that surround the project area and may have perennial flow at higher altitudes. As the streams descend to the valley bottoms where the majority of the proposed transmission line would be constructed, virtually no water exists in the streambeds or rivers, except locally after infrequent, heavy cloudbursts. The proposed transmission line would cross numerous dry washes and ephemeral streambeds. The proposed transmission line would cross Lucerne Lake and Rabbit Lake which are actually large playas. Depending on the year, these playas may contain water from runoff for as much as two months of the year. The proposed transmission line would cross the Mojave River south of Hesperia. The Mojave River originates in the San Bernardino and San Gabriel Mountains and has perennial flow in its upper reaches and near Victorville in the vicinity of Camp Cady and in Afton Canyon. In these places, hard rock barriers force the groundwater to the surface. However, where the proposed transmission line would cross the Mojave River, the flow is ephemeral. No floodplains would be affected by the proposed transmission line. Surveys would be conducted to identify any wetlands or Waters of the U.S. that would be regulated by the United States Army Corps of Engineers.

Groundwater Resources. The proposed transmission line corridor includes sections of the Colorado River and South Lahontan Hydrologic regions as defined by DWR (SES 2008a). The boundary between the two hydrologic regions is a series of mountain ranges (Granite, Rodman, and Ord) that divide those watersheds draining south towards the Colorado River and those draining north. Many of the alluvial valleys in these hydrologic regions are underlain by groundwater aquifers. In most of the smaller basins, the groundwater is found in unconfined alluvial aquifers. Some of the larger basins, or near dry lakes (Lucerne Lake and Rabbit Lake), aquifers may be separated by aquitards that create confined groundwater conditions. The basins range in depth from tens to hundreds of feet in smaller basins and up to thousands of feet in the larger basins. The aquifers range in thickness from tens to hundreds of feet (SES 2008a). The chemical character of the groundwater in these hydrologic regions is variable, but commonly is characterized by calcium or sodium bicarbonate. Typically, the edges of the valleys contain lower TDS than groundwater found beneath the central part of the valleys or near dry lakes. Drinking water standards are most often exceeded for TDS, fluoride, or boron content.

Waters of the United States and State Jurisdictional Waters. The project area encompasses four regional watershed hydrologic units: Bessemer, Johnson, Lucerne Lake, and Mojave (see **Soil & Water Table 8**). Using Google Earth aerial images, Calico Solar identified 346 drainage features that would cross the existing and/or proposed transmission corridor (SES 2008a).

Soil & Water Table 8
Regional Watershed Hydrologic Units
of Proposed Transmission Line Corridor

Regional Hydrologic Unit	Acreage
Bessemer	1,546 acres
Johnson	491 acres
Lucerne Lake	5,385 acres
Mojave	6,057 acres
Total Acreage	**13,479 acres**

Source: SES 2008a

Waters of the U.S. The Mojave River is an intrastate water that may be considered jurisdictional by the U.S. Army Corps of Engineers. Four crossings of the Mojave River are vegetated waters that may be federal jurisdictional waters of the U.S. within an ordinary high water mark (OHWM) as defined by 33 CFR 328.3(e). These four areas are sparsely vegetated (<1%) along the fringe of the river with willow (*Salix* sp.) and other riparian vegetation. While final jurisdiction over the Mojave River has not yet been determined by the U.S. Army Corps of Engineers, a preliminary jurisdictional determination was implemented and it is assumed that the U.S. Army Corps would take jurisdiction over this feature.

The U.S. Army Corps may also want to assert jurisdiction over three locations at crossings of the California Aqueduct. A total of 339 other drainage features were determined to be federally non-jurisdictional because they are isolated waters and there is no apparent or likely significant nexus to foreign or interstate commerce. Many of these drainage features also lack an OHWM.

Waters of the State. A total of 41 drainage features were determined to be waters of the state pursuant to Section 1600 of the California Fish and Game Code and the Porter Cologne Water Quality Act. These include the four aforementioned locations that cross sparsely vegetated (<1%) areas of the Mojave River, the three aforementioned locations that traverse sections of the California Aqueduct, and 34 isolated, intrastate waters that fall under CDFG and RWQCB jurisdiction because of the presence of riparian vegetation (e.g., willows) and/or an OHWM.

Other Drainage Features. A total of 305 other drainage features (e.g., swales) were determined to be non-jurisdictional under federal and state regulations because they lacked an OHWM and/or well-defined bed, bank, and channel.

C.7.8.2 ENVIRONMENTAL IMPACTS

For the proposed 500 kV route, new 500 kV lattice steel towers would be installed in the existing and new ROW. Most of the structure sites would likely require minor to substantial grading and new or re-developed access and spur roads. A portion of the 40- to 100-acre expanded Pisgah Substation would consist of impervious materials such as concrete foundations and asphalt concrete paving.

Soils Resources

Construction activities would involve earth disturbance that would increase the potential for erosion. Work sites using larger truck-mounted equipment would likely be limited to areas near angle and/or dead-end towers. Temporary pull and tensioning sites for equipment setup would be susceptible to erosion from minor soil disturbance and compaction as a result of the vehicular traffic and hilly terrain. Impacts associated with soil erosion include increased soil loss and increased sediment yields downstream from disturbed areas. During construction, erosion impacts could result from disturbance or stripping of soils in the area of temporary roadways, which would be subject to wind and water erosion. Minimal erosion would be expected post-construction because the only soil disturbance during operation would be from periodic inspection and maintenance activities when needed. Potential impacts to the project may be caused by flash floods in the existing channels.

Storm Water and Sediment

Construction and operation of the proposed project, including the grading, filling, and rerouting of ephemeral streams, would disturb approximately 8,200 acres of land and increase the transport of storm water and colloidal sediment outside of the project area. Smaller scale projects previously constructed in the project vicinity include the BNSF railroad track, a power transmission line and Interstate Highway 40. Storm water and sediment transport impacts from these developments have been less than significant.

Agricultural Resources. The transmission line would pass adjacent to or through areas designated as Farmland of Statewide Importance and Farmland of Local Importance. These areas account for approximately 1,100 acres, less than 2% of the total acreage of the full build-out option. Thus, the project is not anticipated to contribute to conversion or curtailment of agricultural land use due to the relatively small agricultural areas that the transmission line would pass through (SES 2008a).

Water Resources

The proposed transmission line would only have one major river crossing at the Mojave River. Depending on the transmission route that would be chosen, the crossing would be between 700 and 1,300 feet. This distance would be spanned without affecting the riverbed or the riparian habitat on either side of the river. The proposed transmission line would also cross Rabbit Lake and Lucerne Lake and would span any water bodies or sensitive riparian areas. The rest of the proposed transmission line only crosses dry washes or ephemeral streambeds that would be spanned. Access roads would be designed to minimize impacts to jurisdictional wetlands and Waters of the U.S. Construction activities associated with new structures would not occur within any watercourses; therefore, impacts to water quality for construction and operation of the transmission lines would be less than significant. Implementation of mitigation for temporary erosion control measures would ensure less than significant impacts to soils associated with new structure construction.

Groundwater resources would not be impacted because water tables are located in formations below any of the construction. The appropriate mitigation measures discussed below would ensure that contaminants would not enter the groundwater supply.

C.7.8.3 MITIGATION

The CWA (33 U.S.C. Section 1251 *et seq.*), formerly the Federal Water Pollution Control Act of 1972, regulates discharges through the NPDES permit process (CWA Section 402). In California, the NPDES program is administered by the SWRCB. Pursuant to NPDES permit requirements, SCE would be required to prepare and adhere to a SWPPP that would minimize construction erosion. During construction activities, measures would be in place to insure that contaminates would not be discharged from the construction site. The SWPPP would define areas where hazardous materials, such as concrete, would be stored; where trash would be placed; where rolling equipment would be parked, fueled and serviced and where construction materials such as reinforcing bars and structural steel members would be staged. Erosion control during grading of the unfinished site and during subsequent construction would be in place and monitored as specified by the SWPPP. A silting basin(s) would be established to capture silt and other materials which might otherwise be carried from the site by rainwater surface runoff.

In addition to conformance with SCE's SWPPP, for temporary disturbance areas, similar mitigation measures to the following are recommended for implementation:

- On completing the work, all work areas except access trails should be scarified or left in a condition that would facilitate natural or appropriate vegetation, provide for proper drainage, and prevent erosion.
- Disturbance and removal of soils and vegetation should be limited to the minimum area necessary for access and construction.
- Vehicles should be inspected daily for fluid leaks before leaving the staging area.
- Implement spill controls and cleanup as needed and as specified in permits and work plans and according to SCE's guidelines for hazardous waste handling. Spill-control and cleanup procedures and materials should be at hand during construction, and workers should be trained in their use.
- Nonbiodegradable debris should not be deposited in the ROW.

The additional following suggested mitigation measures or similar should be implemented for earth disturbance activities associated with work on tower footings:

- Removed topsoil should be segregated and stockpiled for reuse if practicable.
- All soil excavated for structure foundations should be backfilled and tamped around the foundations, and used to provide positive drainage around the structure foundations.
- Use of ground-disturbing mechanical equipment to remove vegetation should be avoided on slopes over 40%, unless the threat of erosion would be minimal because of bedrock, or reseeding would be performed.
- All activity should be minimized during winter and other wet periods to prevent damage (excessive rutting, unacceptable erosion of fines from road surface, excessive soil compaction).

- Where soil has been severely disturbed and the establishment of vegetation is needed to minimize erosion, appropriate measures, as approved by the land manager, should be implemented to establish an adequate cover of grass or other vegetation as needed. Soil preparation, seeding, mulching, and fertilizing should be repeated as necessary to secure soil stabilization and revegetation acceptable to the land manager.
- Grading should be minimized to the extent possible. When required, grading should be conducted away from watercourses/washes to reduce the potential for material to enter the watercourse.
- Grading operations should be consistent with the San Bernardino County Grading Ordinance. SCE should prepare and implement a detailed Erosion Control Plan before construction, which may be a component of the SWPPP.
- Disturbed areas that would not be covered with structures (e.g., buildings or collectors) or pavement following grading and/or cut-and-fill operations should be stabilized. Stabilization methods should include moisturizing and compacting and/or application of polymeric soil stabilizers.
- Should SCE need to relocate or construct a structure or access/spur road, SCE should consult with the United States Army Corps of Engineers (USACE) to locate all new structures and access roads outside floodplains to the extent feasible.
- Sediment control devices, such as placement of native rock, should be used at all dry wash crossings.
- Run-off control structures, diversion ditches, and erosion-control structures should be cleaned, maintained, repaired, and replaced whenever necessary.
- All discharge water created by construction (e.g., concrete washout, pumping for work area isolation, vehicle wash water, drilling fluids) should be treated before discharge.

The following mitigation measures should be implemented for construction activities in and around any water bodies or desert washes associated with the new tower footings, if necessary:

- Wetland delineation surveys should be conducted before each phase of project construction to identify jurisdictional wetlands and Waters of the U.S.
- Mitigation for the permanent loss of jurisdictional wetlands or Water of the U.S. should be provided per agreement with the US Army Corps of Engineers.
- Access ways should be located to avoid wetlands, where practical; or if they are linear, to cross them at the least sensitive feasible point.
- Any discharge of material (displaced soils and, in certain circumstances, vegetation debris) within waters of the United States may be subject to US Army Corps of Engineers regulations under the Clean Water Act.
- If wet areas cannot be avoided, SCE should use wide-track and/or balloon tire vehicles and equipment and or timber mats.

- Excavated material or other construction materials should not be stockpiled or deposited near or in stream banks or other watercourse perimeters.
- All fill or rip-rap placed within a stream or river channel should be limited to the minimum area required for access or protection of existing SCE facilities.

SCE should be required to coordinate with grazing operators to ensure that agricultural productivity and animal welfare are maintained both during and after construction to the maximum extent feasible. Coordination efforts should address issues including, but not necessarily limited to:

- Interference with access to water (e.g., provide alternate methods for livestock access to water)
- Impairment of cattle movements (e.g., provide alternate routes; reconfigure fencing/gates)
- Removal and replacement of fencing (e.g., during construction install temporary fencing/barriers, as appropriate, and following construction restore equal or better fencing to that which was removed or damaged)
- Impacts to facilities such as corrals and watering structures, as well as related effects such as ingress/egress, and management activities (e.g., replacement of damaged/removed facilities in kind; provide alternate access)

During operation cattle would likely be free to move across the transmission ROW and thus impacts to agricultural resources during operation would be less than significant.

C.7.8.4 CONCLUSION

Significant environmental impacts to soil and water resources would be avoided by implementing best management practices, the SWPPP, and/or similar mitigation, as listed above. The project would not cause a displacement of agricultural land use, and neither construction nor operation of the transmission line would cause a significant impact to agricultural resources.

C.7.9 CUMULATIVE IMPACT ANALYSIS

A project may result in a significant adverse cumulative impact where its effects are cumulatively considerable. "Cumulatively considerable" means that the incremental effects of an individual project are significant when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects (California Code Regulation, Title 14, section 15130). NEPA states that cumulative effects could result from individually minor but collectively significant actions taking place over a period of time (40 CFR §1508.7). There is the potential for future development in the Lavic Valley area and throughout the southern Mojave Desert region. Cumulative impacts can occur if implementation of the proposed project could combine with those of other local or regional projects. The locations of existing and reasonably foreseeable developments in the Lavic Valley area are presented in the Cumulative Scenario section of this document, including **Cumulative Scenario Figure 3**.

C.7.9.1 GEOGRAPHIC EXTENT

The area of cumulative effect varies by resource. For example, air quality impacts tend to disperse over a large area, while traffic impacts are typically more localized. For this reason, the geographic scope for the analysis of cumulative impacts must be identified for each resource area.

The analysis of cumulative effects considers a number of variables including geographic (spatial) limits, time (temporal) limits, and the characteristics of the resource being evaluated. The geographic scope of each analysis is based on the topography surrounding the Calico Solar Project and the natural boundaries of the resource affected, rather than jurisdictional boundaries. The geographic scope of cumulative effects will often extend beyond the scope of the direct effects, but not beyond the scope of the direct and indirect effects of the proposed action and alternatives.

In addition, each project in a region will have its own implementation schedule, which may or may not coincide or overlap with the Calico Solar Project's schedule. This is a consideration for short-term impacts from the Calico Solar Project. However, to be conservative, the cumulative analysis assumes that all projects in the cumulative scenario are built and operating during the operating lifetime of the Calico Solar Project.

C.7.9.2 EXISTING CUMULATIVE CONDITIONS

The project site and surrounding vicinity is undeveloped desert. No known users of groundwater exist in the project site vicinity. The BNSF railroad and I-40 are existing structures in the site vicinity. Stormwater runoff is deflected by these structures and constrained to flow through culverts and trestles. This stormwater ultimately flows westerly along I-40 and contributes surface waters to Troy Dry Lake. Project stormwater management, as proposed by the applicant, will prevent stormwater runoff, in addition to existing conditions, from the project to contribute additional flows to the drainage and ultimately to Troy Dry Lake.

The proposed water supply for the project is a groundwater well located in Cadiz, CA. Other users of groundwater in the Cadiz Valley include the Cadiz Co. (agriculture), a private individual (Mr. Chambliss) who sells his well water to nearby residents, and a salt production enterprise located at Cadiz Dry Lake.

C.7.9.3 FUTURE FORESEEABLE PROJECTS

The intensity, or severity, of the cumulative effects should consider the magnitude, geographic extent, duration and frequency of the effects (CEQ, 1997). The magnitude of the effect reflects the relative size or amount of the effect; the geographic extent considers how widespread the effect may be; and the duration and frequency refer to whether the effect is a one-time event, intermittent, or chronic (CEQ, 1997).

Each discipline evaluates the impacts of the proposed project on top of the current baseline; the past, present (existing) and reasonably foreseeable or probable future projects in the Calico Solar vicinity as illustrated in **Cumulative Impacts Figure 3 (Newberry Springs/Ludlow Area Existing and Future/Foreseeable Projects)** and **Cumulative Impacts Tables 2 and 3**.

Reasonably foreseeable projects that could contribute to the cumulative effects scenario depend on the extent of resource effects, but could include projects in the immediate Ludlow area as well as other large renewable projects in the California, Nevada, and Arizona desert regions. These projects are illustrated in **Cumulative Impacts Figures 1, 2,** and **3**. As shown in the map and table, there are a number of projects in the immediate area around Calico Solar whose impacts could combine with those of the proposed project. As shown on **Cumulative Impacts Figure 1** and in **Cumulative Impacts Table 1**, solar and wind development applications for use of BLM land have been submitted for approximately 1 million acres of the California Desert Conservation Area. Additional BLM land in Nevada and Arizona also has applications for solar and wind projects.

Soil & Water Table 9
Renewable Energy Projects in the California Desert District

BLM Field Office	Number of Projects & Acres	Total MW
SOLAR ENERGY		
Barstow Field Office	18 projects 132,560 acres	12,875 MW
El Centro Field Office	7 projects 50,707 acres	3,950 MW
Needles Field Office	17 projects 230,480 acres	15,700 MW
Palm Springs Field Office	17 projects 123,592 acres	11,873 MW
Ridgecrest Field Office	4 projects 30,543 acres	2,835 MW
TOTAL – CA Desert District	63 projects 567,882 acres	47,233 MW
WIND ENERGY		
Barstow Field Office	25 projects 171,560 acres	n/a
El Centro Field Office	9 projects (acreage not given for 3 of the projects) 48,001 acres	n/a
Needles Field Office	8 projects 115,233 acres	n/a
Palm Springs Field Office	4 projects 5,851 acres	n/a
Ridgecrest Field Office	16 projects 123,379 acres	n/a
TOTAL – CA Desert District	62 projects 433,721 acres	n/a

Source: Renewable Energy Projects in the California Desert Conservation Area identifies solar and wind renewable projects as listed on the BLM California Desert District Alternative Energy Website (BLM 2009)

Soil & Water Table 10
Renewable Energy Projects on State and Private Lands

Project Name	Location	Status
SOLAR PROJECTS		
Abengoa Mojave Solar Project (250 MW solar thermal)	San Bernardino County, Harper Lake	Under environmental review
Rice Solar Energy Project (150 MW solar thermal)	Riverside County, north of Blythe	Under environmental review
3 MW solar PV energy generating facility	San Bernardino County, Newberry Springs	MND published for public review
Blythe Airport Solar 1 Project (100 MW solar PV)	Blythe, California	MND published for public review
First Solar's Blythe (21 MW solar PV)	Blythe, California	Under construction
California Valley Solar Ranch (SunPower) (250 MW solar PV)	Carrizo Valley, San Luis Obispo County	Under environmental review
LADWP and OptiSolar Power Plant (68 MW solar PV)	Imperial County, SR 111	Under environmental review
Topaz Solar Farm (First Solar) (550 MW solar PV)	Carrizo Valley, San Luis Obispo County	Under environmental review
AV Solar Ranch One (230 MW solar PV)	Antelope Valley, Los Angeles County	Under environmental review
Bethel Solar Hybrid Power Plant (49.4 MW hybrid solar thermal and biomass)	Seeley, Imperial County	Under environmental review
Mt. Signal Solar Power Station (49.4 MW hybrid solar thermal and biomass)	8 miles southwest of El Centro, Imperial County	Under environmental review
WIND PROJECTS		
Alta-Oak Creek Mojave Project (up to 800 MW)	Kern County, west of Mojave	Under environmental review
PdV Wind Energy Project (up to 300 MW)	Kern County, Tehachapi Mountains	Approved
Solano Wind Project Phase 3 (up to 128 MW)	Montezuma Hills, Solano County	Under environmental review
Hatchet Ridge Wind Project	Shasta County, Burney	Under construction
Lompoc Wind Energy Project	Lompoc, Santa Barbara County	Approved
Pacific Wind (Iberdrola)	McCain Valley, San Diego County	Under environmental review
TelStar Energies, LLC (300 MW)	Ocotillo Wells, Imperial County	Under environmental review
GEOTHERMAL PROJECTS		
Buckeye Development Project	Geyserville, Sonoma	Under environmental review
Orni 18, LLC Geothermal Power Plant (49.9 MW)	Brawley, Imperial County	

Source: CEQAnet [http://www.ceqanet.ca.gov/ProjectList.asp], November 2009.

Soil & Water Table 11
Existing Projects in the Newberry Springs/Ludlow Area

ID	Project Name	Location	Agency/ Owner	Status	Project Description
1	Twentynine Palms Marine Corps Air Ground Combat Center (MCAGCC)	Morongo Basin (to the south of project site)	U.S. Marine Corps	Existing	The Marine Corps' service-level facility for Marine Air Ground Task Force training. It covers 596,000 acres to the south of the SES I project site and north of the city of Twentynine Palms
2	SEGS I and II	Near Daggett (17 miles west of project site)	Sunray Energy, Inc.	Existing	Solar parabolic trough facilities generating 13.8 MW and 30 MW, respectively.
3	CACTUS (formerly Solar One and Solar Two)	Near Daggett (to the west of project site)	University of California Davis	Existing	A non-working 10 MW solar power tower plant converted by UC Davis into an Air Cherenkov Telescope to measure gamma rays hitting the atmosphere. The site is comprised of 144 heliostats. This project had its last observational run in 2005. SCE has requested funds from the California Public Utilities Commission to decommission the Solar Two project. (UC Davis 2009)
4	Mine	2 miles west of project site along I-40		Existing	Small-scale aggregate operation (SES 2009a, p. 5.3-12)
5	Mine	14 miles west of project site along I-40		Existing	Larger aggregate mining operation that produced less than 500,000 tons per year in 2005 (SES 2008a, p. 5.3-12)

Source: These projects were identified through a variety of sources including the project AFC (SES 2008a, Section 5.18) and websites of the San Bernardino County Land Use Services Department, BLM, CEC and individual projects.

In the Cadiz Valley where the project water supply well is located, staff could only identify one reasonably foreseeable project. Cadiz, Inc is proposing to construct and operate a conjunctive water use project known as the Cadiz Water Conservation and Storage Project that would be used to store and recovery imported water and also extract native groundwater. The Cadiz Water Conservation and Storage Project is designed to provide Southern California with as much as 150,000 acre-feet of groundwater during droughts, emergencies or other periods of need and up to 1 million acre-feet of groundwater storage.

Cumulative Impacts to Soil and Storm Water

Construction and operation of the Calico Solar project would result in both temporary and permanent changes to the soil and storm water drainage patterns at the Project site. Without the use of BMPs that would be incorporated into a final DESCP and construction SWPPP, these changes could incrementally increase local soil erosion and storm water runoff. However, as discussed above, these potential impacts would be prevented or reduced to a level of less than significant through the implementation of

BMPs, a final DESCP, and construction SWPPP, and compliance with all applicable erosion and storm water management LORS. Compliance with these LORS would ensure cumulative impacts would be prevented or reduced to a level of less than significant. With the implementation of **SOIL&WATER-1**, **-2** and **-3**, staff believes the Project would not significantly contribute to the cumulative soil erosion and storm water impacts from other development within the vicinity of the proposed Project.

Cumulative Impacts to the Basin Balance

As discussed above, during construction and operation of the Calico Solar project, the groundwater demand would average 77 AFY during construction and 20 AFY during operation. Over the next 40 years, the use of groundwater in the Cadiz Valley is not expected to increase significantly. As discussed above under Construction and Operation Water Supply impacts the proposed project and current agricultural water use do not appear to exceed basin recharge. Staff believes there would be no cumulatively significant impact to the basin balance. Also, as discussed in the water supply impacts section above, there is a wide range of estimates of recharge and inflows to the Cadiz Valley groundwater basin. It is possible that the current agricultural pumping could exceed the dry year or drought period recharge and over the long term there could be pumping that exceeds recharge. In addition it is unclear how the proposed Cadiz Water Conservation and Storage Project would be operated. Current available information indicates the reasonably foreseeable use of the Cadiz Water Conservation and Storage Project could be up to 150,000 AFY from the Cadiz Valley Groundwater basin during drought periods. It is unclear, however, how the basin would be managed and whether water level or basin balance impacts of any magnitude would be allowed. To evaluate the potential cumulative impacts of the Cadiz Water Conservation and Storage Project and existing agricultural uses, additional information is needed on how the project and groundwater basin would be managed. Staff still believes the project pumping is minor in comparison to the existing agricultural pumping and potential pumping of the storage project, and would not be a significant contribution to potential cumulative impacts. To evaluate the effects and potential impacts related to existing and reasonably foreseeable future pumping from the Cadiz Water Conservation and Storage Project, and potential effects on the project pumping well, staff believes the applicant should be required to monitor groundwater in accordance with Condition of Certification **SOIL&WATER-8.** This condition would require monitoring in accordance with the County of San Bernardino's Groundwater Management Ordinance and allow for evaluation of potential changes in the basin balance related to reasonably foreseeable projects and project pumping in the basin.

Cumulative Impacts to Wells

The Calico Solar project would not cause a cumulatively considerable impact to water levels in other wells in the Cadiz Valley. The reasonably foreseeable groundwater use by other proposed projects in the Cadiz Valley are not expected to increase except where the Cadiz Water Conservation and Storage Project may be developed. As discussed above under Project Construction and Operation Water Supply impacts the project pumping would not result in significant changes in water levels in the basin. Since project pumping in the basin would not result in significant drawdown impacts and the current agricultural pumping has not resulted in any observed impacts staff believes there would not be any significant cumulative effects on water levels. If the reasonably foreseeable Cadiz Water Conservation and Storage Project is developed it is possible there could be cumulatively significant impacts to water levels. Staff believes that given the current understanding of potential water use and pumping for the Cadiz Water Conservation and Storage Project, the project pumping would not likely be a significant contribution to cumulative impacts on water levels. The applicant should be required to monitor groundwater in accordance with Condition of Certification **SOIL&WATER-8**. This condition would require monitoring in accordance with the County of San Bernardino's Groundwater Management Ordinance and allow for evaluation of changes and trends in water levels related to reasonably foreseeable projects and project pumping in the basin.

C.7.10 COMPLIANCE WITH LORS

Clean Water Act

The applicant has not provided information necessary to complete development of requirements for discharges of brine waters to evaporation ponds, sanitary septic systems, and dredge and fill in waters of the state. Once the applicant provides this information, staff can complete development of requirements that will be included in Condition of Certification **SOIL&WATER-2**.

Public Resources Code, Sections 25300 through 25302

Through compliance with Conditions of Certification **SOIL&WATER-4**, information required by staff to conduct assessments and forecasts of potable and industrial water consumption by power plants is achieved. The Commission also promotes "all feasible means" of water conservation and "all feasible uses" of alternative water supply sources (*Section 25008*).

Energy Commission Policy

Sources of Policy

The Energy Commission has four sources for statements of policy relating to water use in California applicable to power plants. They are the California Constitution, the Warren-Alquist Act, the Commission's restatement of the state's water policy in the 2003 Integrated Energy Policy Report ("IEPR") and the State Water Resources Control Board ("SWRCB" or "Board") resolutions (in particular Resolutions 75-58 and 88-63).

California Constitution

California's interest in conserving water is so important to our thirsty state that in 1928, the common law doctrine of reasonable use became part of the state Constitution. Article X, Section 2 calls for water to be put to beneficial use, and that "waste or unreasonable use or unreasonable *method of use* be prevented." (Cal. Const., art. X, § 2; emphasis added.) The article also limits water rights to reasonable use, including reasonable methods of use. (*Ibid*.) Even earlier in the 20th Century, a state Supreme Court case firmly established that groundwater is subject to reasonable use. (*Katz v. Walkinshaw* (1903) 141 Cal. 116.) Thus, as modern technology has made dry-cooling of power plants feasible, the Commission may regard wet-cooling as an unreasonable method of use of surface or groundwater, and even as a wasteful use of the state's most precious resource.

Warren-Alquist Act

Section 25008 of the Commission's enabling statutes echoes the Constitutional concern, by promoting "all feasible means" of water conservation and "all feasible uses" of alternative water supply sources. (Pub. Resources Code § 25008.)

Integrated Energy Policy Report

In the 2003 Integrated Energy Policy Report ("IEPR" or "Report"), the Commission reiterated certain principles from SWRCB's Resolution 75-58, discussed below, and clarified how they would be used to discourage use of fresh water for cooling power plants under the Commission's jurisdiction. The Report states that the Commission will approve the use of fresh water for cooling purposes only where alternative water supply sources or alternative cooling technologies are shown to be "'environmentally undesirable'" or "'economically unsound.'" (IEPR (2003), p. 41.) In the Report, the Commission interpreted "environmentally undesirable" as equivalent to a "significant adverse environmental impact" under CEQA, and "economically unsound" as meaning "economically or otherwise infeasible," also under CEQA. (IEPR, p. 41.) CEQA and the Commission's siting regulations define feasible as "capable of being accomplished in a successful manner within a reasonable amount of time," taking into account economic and other factors. (Cal. Code Regs., tit. 14, § 15364; tit. 20, § 1702, subd. (f).) At the time of publication in 2003, dry cooling was already feasible for three projects — two in operation and one just permitted. (IEPR, p. 39.)

The Report also notes California's exploding population, estimated to reach more than 47 million by 2020, a population that will continue to use "increasing quantities of fresh water at rates that cannot be sustained." (IEPR, p. 39.)

State Water Resources Control Board Resolutions

The SWRCB not only considers quantity of water in its resolutions, but also the quality of water. In 1975, the Board determined that water with total dissolved solids ("TDS") of 1,000 mg/l or less should be considered fresh water. (Resolution 75-58.) One express purpose of that Resolution was to "keep the consumptive use of fresh water for powerplant cooling to that *minimally essential*" for the welfare of the state. (*Ibid*; emphasis added.) In 1988, the Board determined that water with TDS of 3,000 mg/l or less should be protected for and considered as water for municipal or domestic use. (Resolution 88-63.)

When evaluating solar projects, Staff was unsure exactly how to integrate these decisions for water with TDS between 1,000 and 3,000 mg/l. In November, 2009, Staff requested direct help from the Board for a contemporary interpretation of those Resolutions

The Board's response first established that, generally, Commission staff should consider "multiple factors" in its decisions regarding water supplies for power plants. In other words, staff should consider the impacts on the relevant basin, impacts on other basins, the quantity of use proposed, the quality of the water proposed for use, the project's requirements as understood by staff, whether there are any other competing uses for the water supply, and other relevant factors when analyzing a proposed project's water use.

Water with TDS between 1,000 to 3000 mg/l should be generally considered fresh when it involves surface water, and generally not when it involves groundwater. The Board concluded that groundwater should only be used for renewable energy power plants "upon a demonstration that the use of other water supplies or *other methods of cooling* would be 'environmentally undesirable or economically unsound.'" While the Board did not define "economically unsound," it explained that the Water Code compels use of recycled water for industrial uses if recycled water is available, and its cost is equal to or less expensive than using fresh water. Staff also notes that dry-cooling has been amply demonstrated to be feasible and, thus, a potential method of cooling that could avoid the use of groundwater. While staff can independently determine if dry cooling is environmentally undesirable, applicants are in a better position to demonstrate that using dry cooling would be economically unsound. In addition to the operational projects mentioned in the 2003 IEPR that use dry-cooling, owners and applicants continue to demonstrate that dry cooling is feasible and economically sound for their California power plants, including renewables.

San Bernardino County Ordinance 3872 (Code Title 3, Division 3, Chapter 6, Article 5)

To help protect groundwater resources in San Bernardino County, the County enacted Ordinance 3872. This ordinance requires a permit to locate, construct, operate, or maintain a new groundwater well within the unincorporated, unadjudicated desert region of San Bernardino County. CEQA compliance must also be completed prior to issuance of a permit. The article does not apply to "groundwater wells located on Federal lands unless otherwise specified by inter-agency agreement." The BLM and County entered into a MOU that provides that the BLM will require conformance with Article 5 for all projects proposing to use groundwater from beneath public lands. The MOU provides that the County and BLM will work cooperatively together to ensure conformance with applicable LORS by project developers on BLM land. As part of meeting the requirements of the County's permitting process, the County may require the project owner to prepare a groundwater monitoring plan in accordance with the County's "*Guidelines for Preparation of a Groundwater Monitoring Plan*" dated January 1998. Condition of Certification **SOIL&WATER-8** would require the project owner to ensure that all onsite groundwater wells would be installed in accordance with the County of San Bernardino requirements and to submit a well construction packet to the County for comment and written evaluation. The project owner would also be required to submit well completion reports to the DWR in accordance with the DWR well completion reporting requirements.

Calico Solar Project

The applicant for the Calico Solar Power Project proposes the use of 34,000 SunCatchers, each containing a single Stirling engine. The Stirling engines are designed to use closed loop air cooled radiators, which achieves maximum water conservation associated with cooling. Other than dust suppression and potable consumption, water use would be limited to mirror washing and hydrogen gas generation. During operation, the applicant estimates approximate 20 acre-feet of water will be required each year. Groundwater is the only available source of water and the closest location available to provide water for the project is located in Cadiz, approximately 64 miles away from the site. Water is the only feasible means of cleaning the mirrors, which must be clean to maintain efficiency of output of Stirling Engine power plants.

Groundwater occurrence and quality varies significantly within the Mojave Desert. The applicant conducted field explorations adjacent to the project site to evaluate groundwater resource characteristics. The applicant found that drilling was difficult, groundwater was not abundant and what groundwater that was encountered was of relatively poor quality (high TDS). The applicant pursued alternate water sources and discovered a well in Cadiz that had previously been used to provide water for steam locomotives, but now sat idle. Documentation indicates that the well penetrates a high capacity aquifer of good quality water.

State, SWRCB and Energy Commission water policies encourage the use of the least amount of the lowest quality water feasibly available. As discussed in Section C.7.4.4, site groundwater has contained elevated concentration of TDS. In addition, preliminary results of ongoing near- site groundwater resource exploration have indicated limited availability of site groundwater. While lower quality groundwater water was discovered adjacent to the site, due to its limited availability it was considered by the applicant to be unfeasible for power plant use. Other sources of water were considered and evaluated, and were considered unfeasible for this project. Therefore, due to the inadequate supply of degraded water, the low volume of water required for project operation, the absence of a need for water used in power plant cooling and the relatively high output generated (850 MW), staff believes the proposed project complies with the State, SWRCB and Energy Commission water policies.

C.7.11 NOTEWORTHY PUBLIC BENEFITS

Staff has not identified any noteworthy public benefits associated with hydrology, water use, and water quality.

C.7.12 FACILITY CLOSURE

According to Section 3.12 of the applicant’s project description, the solar generating facility is expected to have a lifespan of 40 years. At any point during this time, temporary or permanent closure of the solar facility could occur. Temporary closure would be a result of necessary maintenance, hazardous weather conditions, or damage due to a natural disaster. Permanent closure would be result of damage that is beyond repair, adverse economic conditions, or other significant reasons.

Both temporary and permanent closures would require the applicant to submit to the Energy Commission and BLM a contingency plan or a decommissioning plan, respectively. A contingency plan would be implemented to ensure compliance with applicable LORS, and appropriate shutdown procedures depending on the length of the cessation. A decommissioning plan would be implemented to ensure compliance with applicable LORS, removal of equipment and shutdown procedures, site restoration, potential decommissioning alternatives, and the costs and source of funds associated with decommissioning activities.

After the end of the project's useful life, it would be decommissioned as described in the applicant's Draft Closure, Revegetation, and Rehabilitation Plan. The facility would be removed to a depth of 3 feet below grade, original contours restored, and the site revegetated. However, the removal of the existing facility could cause substantial disturbance to soil and water resources. The project closure would require many of the same resource protection plans as required for construction, and thus, staff concludes that the impacts to soil and water resources would be less than significant.

C.7.13 PROPOSED CONDITIONS OF CERTIFICATION/MITIGATION MEASURES

DRAINAGE EROSION AND SEDIMENTATION CONTROL PLAN

SOIL & WATER-1 Prior to site mobilization, the project owner shall obtain both BLM's Authorized Officer and the CPM's approval for a site specific Drainage, Erosion and Sediment Control Plan (DESCP) that ensures protection of water quality and soil resources of the project site and all linear facilities for both the construction and operation phases of the project. This plan shall address appropriate methods and actions, both temporary and permanent, for the protection of water quality and soil resources, demonstrate no increase in off-site flooding potential, and identify all monitoring and maintenance activities. The project owner shall complete all necessary engineering plans, reports, and documents necessary for both BLM's Authorized Officer and the CMP to conduct a review of the proposed project and provide a written evaluation as to whether the proposed grading, drainage improvements, and flood management activities comply with all requirements presented herein. The plan shall be consistent with the grading and drainage plan as required by Condition of Certification **CIVIL-1** and shall contain the following elements:

- **Vicinity Map:** A map shall be provided indicating the location of all project elements with depictions of all major geographic features to include watercourses, washes, irrigation and drainage canals, major utilities, and sensitive areas.
- **Site Delineation:** The site and all project elements shall be delineated showing boundary lines of all construction areas and the location of all existing and proposed structures, underground utilities, roads, and drainage facilities. Adjacent property owners shall be identified on the plan maps. All maps shall be presented at a legible scale
- **Drainage:** The DESCP shall include the following elements:

    a. Topography. Topography for offsite areas is required to define the existing upstream tributary areas to the site and downstream to provide enough definition to map the existing storm water flow and flood hazard. Spot elevations shall be required where relatively flat conditions exist.

b. Proposed Grade. Proposed grade contours shall be shown at a scale appropriate for delineation of onsite ephemeral washes, drainage ditches, and tie-ins to the existing topography.

c. Hydrology. Existing and proposed hydrologic calculations for onsite areas and offsite areas that drain to the site; include maps showing the drainage area boundaries and sizes in acres, topography and typical overland flow directions, and show all existing, interim, and proposed drainage infrastructure and their intended direction of flow.

d. Hydraulics. Provide hydraulic calculations to support the selection and sizing of the onsite drainage network, diversion facilities and BMPs.

- **Watercourses and Critical Areas:** The DESCP shall show the location of all onsite and nearby watercourses including washes, irrigation and drainage canals, and drainage ditches, and shall indicate the proximity of those features to the construction site. Maps shall identify high hazard flood prone areas.
- **Clearing and Grading:** The plan shall provide a delineation of all areas to be cleared of vegetation, areas to be preserved, and areas where vegetation would be cut to allow clear movement of the heliostats. The plan shall provide elevations, slopes, locations, and extent of all proposed grading as shown by contours, cross-sections, cut/fill depths or other means. The locations of any disposal areas, fills, or other special features shall also be shown. Existing and proposed topography tying in proposed contours with existing topography shall be illustrated. The DESCP shall include a statement of the quantities of material excavated at the site, whether such excavations or fill is temporary or permanent, and the amount of such material to be imported or exported or a statement explaining that there would be no clearing and/or grading conducted for each element of the project. Areas of no disturbance shall be properly identified and delineated on the plan maps.
- **Soil Wind and Water Erosion Control:** The plan shall address exposed soil treatments to be used during construction and operation of the proposed project for both road and non-road surfaces including the specific identification of all chemical-based dust palliatives, soil bonding, and weighting agents appropriate for use at the proposed project site that would not cause adverse effects to vegetation. BMPs shall include measures designed to prevent wind and water erosion including application of chemical dust palliatives after rough grading to limit water use. All dust palliatives, soil binders, and weighting agents shall be approved by both BLM’s Authorized Officer and the CPM prior to use. With regard to erosion risk and stormwater runoff, debris and detention basins shall be installed which are sized and located to intercept storm water flow from off-site areas as it enters the project site. On-site roadways and other infrastructure shall be designed and located to avoid existing and proposed flow paths to the extent feasible.

- **Project Schedule:** The DESCP shall identify on the topographic site map the location of the site-specific BMPs to be employed during each phase of construction (initial grading, project element construction, and final grading/stabilization). Separate BMP implementation schedules shall be provided for each project element for each phase of construction. This scheduling should require the installation of debris basins, detention/infiltration basins, swales, and related storm water management facilities before construction commences on each phase.
- **Best Management Practices:** The DESCP shall show the location, timing, and maintenance schedule of all erosion- and sediment-control BMPs to be used prior to initial grading, during project element excavation and construction, during final grading/stabilization, and after construction. BMPs shall include measures designed to control dust and stabilize construction access roads and entrances. The maintenance schedule shall include post-construction maintenance of treatment-control BMPs applied to disturbed areas following construction.
- **Erosion Control Drawings:** The erosion-control drawings and narrative shall be designed, stamped and sealed by a professional engineer or erosion-control specialist.
- **Agency Comments:** The DESCP shall include copies of recommendations, conditions, and provisions from the County of San Bernardino, California Department of Fish and Game (CDFG), and Lahontan Regional Water Quality Control Board (RWQCB).
- **Monitoring Plan:** Monitoring activities shall include routine measurement of the volume of accumulated sediment in the onsite drainage ditches, and storm water diversions and the requirements specified in Appendix B, C, and D.

<u>Verification:</u> The DESCP shall be consistent with the grading and drainage plan as required by Condition of Certification **CIVIL-1**, and relevant portions of the DESCP shall clearly show approval by the chief building official (CBO). In addition, the project owner shall do all of the following:

a. No later than ninety (90) days prior to start of site mobilization, the project owner shall submit a copy of the DESCP to the County of San Bernardino, the RWQCB, the BLM's authorized officer, and CMP for review and comment. Both BLM's Authorized Officer and the CPM shall consider comments received from San Bernardino County and RWQCB.

b. During construction, the project owner shall provide an analysis in the monthly compliance report on the effectiveness of the drainage-, erosion- and sediment-control measures and the results of monitoring and maintenance activities.

c. Once operational, the project owner shall provide in the annual compliance report information on the results of storm water BMP monitoring and maintenance activities.

d. Provide BLM's Authorized Officer and the CPM with two (2) copies each of all monitoring or other reports required for compliance with San Bernardino County, CDFG, and RWQCB.

WASTE DISCHARGE REQUIREMENTS

SOIL&WATER-2 Requirements for discharges of brine waters to evaporation ponds, dredge and fill in waters of the state, and sanitary septic systems, are pending receipt of information to be submitted by the applicant. Once this information has been submitted, requirements will be developed and included in the SSA/DEIS.

STORM WATER DAMAGE MONITORING AND RESPONSE PLAN

SOIL&WATER-3 The project owner shall ensure that all SunCatcher pole foundations are designed to withstand storm water scour from surface erosion and/or channel migration. The project owner shall also develop a Storm Water Damage Monitoring and Response Plan to evaluate potential impacts from storm water, including pole foundations that fail due to storm water flow or otherwise break and scatter mirror debris and other SunCatcher components on to the ground surface. The Storm Water Damage Monitoring and Response Plan shall include the following elements:

- Detailed maps showing the installed location of all SunCatcher pole foundations within each project phase, including existing and proposed drainage channels.
- Each SunCatcher pole foundation should be identified by a unique ID number marked to show initial ground surface at its base, and the depth to the tip of the pole below ground.
- Minimum Depth Stability Threshold to be maintained of SunCatcher pole foundations to meet long-term stability for applicable wind, water and debris loading effects;
- Above and below ground construction details of a typical installed SunCatcher pole foundation.
- BMPs to be employed to minimize the potential impact of broken mirrors to soil resources.
- Methods and response time of mirror cleanup and measures that may be used to mitigate further impact to soil resources from broken mirror fragments.

Monitor and Inspect Periodically, Before First Seasonal and After Every Storm Event:

- Security and Tortoise Exclusion Fence: Inspect for damage and buildup of sediment or debris
- SunCatcher Pole Foundations within Drainages or Subject to Drainage Overflow: Inspect for tilting, mirror damage, depth of scour compared to foundation depth below ground and the Minimum Depth Stability Threshold, collapse, and downstream transport.
- Drainage Channels: Inspect for substantial migration or changes in depth, and transport of broken mirror glass.

- Constructed Diversion Channels: Inspect for scour and structural integrity issues caused by erosion, and for sediment and debris buildup.

Short-Term Incident-Based Response:

- Security and Tortoise Exclusion Fence: repair damage, and remove build-up of sediment and debris.
- SunCatcher Pole Foundations: Remove broken glass, damaged structures, and wiring from the ground, and for foundations no longer meeting the Minimum Depth Stability Threshold, either replace/reinforce or remove the SunCatcher to avoid exposure for broken glass.
- Drainage Channels: no short-term response necessary unless changes indicate risk to facility structures.
- Constructed Diversion Channels: repair damage, maintain erosion control measures and remove built-up sediment and debris.

Long-Term Design-Based Response:

- Propose operation/BMP modifications to address ongoing issues. Include proposed changes to monitoring and response procedures, frequency, or standards.
- Replace/reinforce SunCatcher Pole Foundations no longer meeting the Minimum Depth Stability Threshold or remove the SunCatchers to avoid exposure for broken glass.
- Propose design modifications to address ongoing issues. This may include construction of active storm water management diversion channels and/or detention ponds.

Inspection, short-term incident response, and long-term design-based response may include activities both inside and outside of the approved right-of-way. For activities outside of the approved right-of-way, the applicant will notify BLM and acquire environmental review and approval before field activities begin.

Verification: At least sixty (60) days prior to commercial operation, the project owner shall submit to both BLM's Authorized Officer and the CPM a copy of the Storm Water Damage Monitoring and Response Plan for review and approval prior to commercial operation. The project owner shall retain a copy of this plan onsite at the power plant at all times. The project owner shall prepare an annual summary of the number of heliostats failed, cause of the failure, and cleanup and mitigation performed for each failed heliostat.

CONSTRUCTION AND OPERATIONS WATER USE

SOIL&WATER-4 The proposed project's use of groundwater for all construction activities shall not exceed 245 AFY. The proposed project's use of groundwater for all operational activities shall not exceed 20 AFY. Prior to the use of groundwater for construction, the project owner shall install and maintain metering devices as part of the water supply and distribution system to document project water use and to monitor and record in gallons per day the total volume(s) of water supplied to the project from the water source. The metering devices shall be operational for the life of the project.

Verification: At least sixty (60) days prior to the start of construction of the proposed project, the project owner shall submit to both BLM's Authorized Officer and the CPM a copy of evidence that metering devices have been installed and are operational.

Beginning six (6) months after the start of construction, the project owner shall prepare a semi-annual summary of amount of water used for construction purposes. The summary shall include the monthly range (daily minimum and daily maximum) and monthly average of daily water usage in gallons per day.

The project owner shall prepare an annual summary, which will include daily usage, monthly range and monthly average of daily water usage in gallons per day, and total water used on a monthly and annual basis in AF. For years subsequent to the initial year of operation, the annual summary will also include the yearly range and yearly average water use by source. For calculating the total water use, the term "year" will correspond to the date established for the annual compliance report submittal.

ASSURED WATER SUPPLY

SOIL&WATER-5 The project owner shall provide the Authorized Officer (AO) and the Compliance Project Manager (CPM) two copies of an executed Water Purchase Agreement (agreement) with the water purveyor (BNSF) for the long-term supply (30-35 years) of fresh water to the Project. The project shall not begin construction without a long term agreement for water delivery for project use. The agreement shall specify a delivery rate to meet the Project's maximum operation requirements and all terms and costs for the delivery and use of water at the Project. The Project shall not begin construction and initiate operation without the final agreement in place and submitted to the AO and CPM.

Verification: No later than 60 days prior to beginning construction, the project owner shall submit two copies of the executed agreement for the supply and on-site use of water at the Calico Solar Project. The agreement shall specify that the water purveyor can deliver water at a maximum rate up to 175,000 gpd at least through the construction phase and would provide the Project a minimum of 20 acre-feet per year for operation.

SEPTIC SYSTEM AND LEACH FIELD REQUIREMENTS

SOIL&WATER-6 Prior to the start of construction, the project owner shall comply with the County of San Bernardino requirements for the construction and operation of the project's proposed sanitary waste septic system and leach field. Project construction shall not proceed until documentation equivalent to the County's required wastewater treatment system permits are issued by the County and approved by both BLM's AO and the CPM. The project owner shall remain in compliance with the County requirements for the life of the project.

Verification: The Project owner will submit all necessary information and the appropriate fee to the County of San Bernardino to ensure that the County can assess the project's compliance with the County's sanitary waste disposal facilities requirements. A written assessment prepared by the County of San Bernardino of the project's compliance with these requirements must be provided to the CPM sixty (60) days prior to the start of operation.

DECOMMISSIONING PLAN

SOIL&WATER-7 The Project owner shall identify likely decommissioning scenarios and develop specific decommissioning plans for each scenario that will identify actions to be taken to avoid or mitigate long-term impacts related to water and wind erosion after decommissioning. Actions may include such measures as a decommissioning SWPPP, revegetation and restoration of disturbed areas, post-decommissioning maintenance, collection and disposal of project materials and chemicals, and access restrictions.

Verification: At least 90 days prior to the start of site mobilization, the project owner shall submit decommissioning plans to the AO and CPM for review and approval prior to site mobilization. The project owner shall amend these documents as necessary, with approval from the AO and CPM, should the decommissioning scenario change in the future.

GROUNDWATER LEVEL MONITORING AND REPORTING PLAN

SOIL&WATER-8 The project owner shall submit a Groundwater Level Monitoring and Reporting Plan to San Bernardino County for review and both BLM's Authorized Officer and the CPM for review and approval in accordance with the County of San Bernardino Code Title 2, Division 3, Chapter 6, Article 5 (Desert Groundwater Management Ordinance). The Groundwater Level Monitoring and Reporting Plan shall provide detailed methodology for monitoring background and site groundwater levels. Monitoring shall include pre-construction, construction, and project operation water use. The primary objective for the monitoring is to establish pre-construction and project related groundwater level trends that can be quantitatively compared against observed and simulated trends near the project pumping well and existing wells.

Prior to project construction, monitoring shall commence to establish pre-construction base-line conditions and shall incorporate any existing monitoring and reporting data collected in the project area. The monitoring network shall be designed to incorporate any ongoing monitoring and reporting program currently occurring in the Cadiz Valley groundwater basin. The monitoring plan and network may make use of existing wells in the basin that would satisfy the requirements for the monitoring program.

Verification: The project owner shall complete the following:

1. At least two (2) months prior to construction, a Groundwater Level Monitoring and Reporting Plan shall be submitted to the County of San Bernardino for review and comment before completion of Condition of Certification **SOIL& WATER-3**, and a copy of the County's comments and the plan shall be submitted to both BLM's Authorized Officer and the CPM for review and approval. The plan shall include a scaled map showing the site and vicinity, existing well locations, and proposed monitoring locations (both existing wells and new monitoring wells proposed for construction). The map shall also include relevant natural and man-made features

(existing and proposed as part of this project). The plan also shall provide: (1) well construction information and borehole lithology for each existing well proposed for use as a monitoring well; (2) description of proposed drilling and well installation methods; (3) proposed monitoring well design; and, (4) schedule for completion of the work.

2. At least one (1) month prior to construction, a Well Monitoring Installation and Groundwater Level Network Report shall be submitted to both BLM's Authorized Officer and the CPM. The report shall include a scaled map showing the final monitoring well network. It shall document the drilling methods employed, provide individual well construction as-builds, borehole lithology recorded from the drill cuttings, well development, and well survey results. The well survey shall measure the location and elevation of the top of the well casing and reference point for all water level measurements, and shall include the coordinate system and datum for the survey measurements. Additionally, the report shall describe the water level monitoring equipment employed in the wells and document their deployment and use.
3. As part of the monitoring well network development, any newly constructed monitoring wells shall be permitted and constructed consistent with San Bernardino County and State specifications.
4. At least one (1) week prior to project construction, all water level monitoring data shall be provided to both BLM's Authorized Officer and the CPM. The data transmittal shall include an assessment of pre-project water level trends, a summary of available climatic information (monthly average temperature and rainfall records from the nearest weather station), and a comparison and assessment of water level data.
5. After project construction and during project operations, the project owner shall submit the monitoring data annually to both BLM's Authorized Office and the CPM. The summary shall document water level monitoring methods, the water level data, water level plots, and a comparison between pre- and post-project start-up water level trends. The report shall also include a summary of actual water use conditions, monthly climatic information (temperature and rainfall), and a comparison and assessment of water level data.

C.7.14 CONCLUSIONS

With the information provided to date, staff has determined that construction, operation, and decommissioning of the proposed project under NEPA could potentially impact soils, surface water drainage, flooding, surface water quality, ground water quality, and groundwater supply. Where these potential impacts have been identified, staff has proposed mitigation measures to reduce identified impacts to levels that are less than significant under CEQA. The mitigation measures, as well as specifications for LORS conformance, are included herein as conditions of certification. The conditions of certification referred to herein address the CEQA requirements for the Energy Commission's analysis and BLM's needs for a NEPA analysis. The project would conform to all applicable LORS. Staff's conclusions based on analysis of the information submitted to-date are as follows:

1. The proposed project would be located in the Mojave Desert of San Bernardino County in an area characterized by braided stream channels, flash flooding, alluvial fan conditions, low rainfall, sparse vegetation, and the potential for wind erosion/ deposition.
2. The project proposes to place more than 34,000 solar dishes, known as SunCatchers, within areas known to be subject to flash flooding and erosion. Project-related changes to the braided and alluvial fan stream hydraulic conditions could result in on-site erosion, stream bed degradation or aggradation, and erosion and sediment deposition impacts to adjacent land. SunCatchers within the stream courses could be subject to destabilization by stream scour. Impacts to soils related to wind erosion and runoff-borne erosion are potentially significant, as are impacts to surface water quality from sedimentation and the introduction of foreign materials, including potential contaminants, to the project area.
3. The applicant completed a hydrologic study and hydraulic modeling of the major stream channels on the project. Based on this work and subsequent analysis by staff, the project can be designed to withstand flash flood flows with minimal damage to SunCatchers. Condition of Certification **SOIL&WATER-3** ensures such a design.
4. A Draft Drainage, Erosion, and Sedimentation Control mitigates the potential project-related storm water and sediment impacts. However, the calculations and assumptions used to evaluate potential storm water and sedimentation impacts are imprecise and have limitations and uncertainties associated with them such that the magnitude of potential impacts that could occur cannot be determined precisely. Based on these factors, the proposed project could result in impacts that would be significant with respect to California Environmental Quality Act significance criteria specified herein and National Environmental Policy Act significance criteria specified in 40 CFR 1508.27. Therefore, Conditions of Certification **SOIL&WATER-1, SOIL&WATER-2** and **SOIL&WATER-3** have been developed that define specific methods of design analysis, development of best management practices, and monitoring and reporting procedures to mitigate impacts related to flooding, erosion, sedimentation, and stream morphological changes. Compliance with LORS, particularly the Clean Water Act requirements, will insure no adverse impacts to waters of the U.S. With implementation of these Conditions, the potential effects of the proposed project would be less than significant. The applicant has not provided information necessary to complete development of requirements for dredge and fill in waters of the state. Once the applicant provides this information staff can complete development of requirements that will be included in Condition of Certification **SOIL&WATER-2.**
5. Surface water and ground water quality could be affected by construction activities, ongoing activities on the project site including mirror washing, vehicle use and fueling , storage of oils and chemicals, the proposed septic and leach field system for sanitary wastes, and wastes from the water treatment system. These impacts are potentially significant. Compliance with laws, ordinances, regulations and standards and Conditions of Certification **SOIL&WATER-1, SOIL&WATER-2, SOIL&WATER-3** and **SOIL&WATER-6** will mitigate to a level less than significant. The applicant has not provided information necessary to complete development of requirements for discharges of brine waters to evaporation ponds or sanitary septic systems. Once the applicant provides this information staff can complete

development of requirements that will be included in Condition of Certification **SOIL&WATER-2.**

6. Impacts to groundwater supply and groundwater quality during construction and operations would be less than significant. SunCatcher mirrors will be spray washed on a regular basis. Mirror washing and dust control watering will comprise the primary water use for the project. Daily maximum water use is estimated to be 43.7gallons per minute (gpm) during construction, with total annual use of approximately 20 AF for operation. Conditions of Certification **SOIL&WATER-2**, **SOIL&WATER-3**, and **SOIL&WATER-4** are proposed by staff to ensure this water supply and treatment system comply with laws, ordinances, regulations and standards and not pose adverse impacts to water quality or supply. The applicant has not provided information necessary to complete development of requirements for discharges of brine waters to evaporation ponds or sanitary septic systems. Once the applicant provides this information staff can complete development of requirements that will be included in Condition of Certification **SOIL&WATER-2**.
7. The proposed project would use air-cooled radiators fitted on each individual engine for heat rejection. Use of this technology would substantially reduce potential water use and is consistent with Energy Commission water policy.

C.7.15 REFERENCES

Boyle 1996 – Boyle Engineering Corp., 1996, Trends in groundwater levels vicinity of Cadiz Land Company production well field Cadiz California: Prepared for Rail-Cycle.

Bredhoeft 2001 – Bredhoeft, J.D., 2001, Revised Comments, Cadiz Groundwater Storage Project – Cadiz & Fenner Valleys, San Bernardino County, California: prepared for the Western Environmental Law Center, Taos, New Mexico.

BOR 1985 – Bureau of Reclamation, United States Department of the Interior, 1985, Ground Water Manual, A Water Resources Technical Publication, United States Government Printing Office.

CEC 2008a – California Energy Commission/E. Knight (tn 49482). Notice of Receipt of the Application for Certification. Submitted to CEC/Docket Unit on December 22, 2008.

CEC 2008b – California Energy Commission/M. Jones (tn 49573). Energy Commission Staff's Data Adequacy Recommendation, dated December 31, 2008. Submitted to CEC/Docket Unit on December 31, 2008.

CEC 2009a – California Energy Commission/M. Jones (tn 51395). Revised Data Adequacy Recommendation, dated April 27, 2009. Submitted to CEC/Docket Unit on May 1, 2009.

CEC 2009d – California Energy Commission/C. Meyer (tn 51972). Issues Identification Report, dated June 12, 2009. Submitted to CEC/Docket Unit on June 12, 2009.

CEC 2009f – California Energy Commission/C. Meyer (tn 52052). CEC and BLM Staff Data Requests Set 1, dated June 17, 2009. Submitted to CEC/Docket Unit on June 17, 2009.

CEC 2009g – California Energy Commission/J. Boyd/J. Byron (tn 52415). Committee Order Granting Basin and Range Watch's Petition to Intervene, dated July 14, 2009. Submitted to CEC/Docket Unit on July 14, 2009.

CEC 2009h – California Energy Commission/C. Meyer (tn 52460). CEC and BLM Staff Data Request Set 1, Part 2, dated July 20, 2009. Submitted to CEC/Docket Unit on July 20, 2009.

CEC 2009i – California Energy Commission/J. Boyd/J. Byron (tn 52605). Committee Scheduling Order, dated July 29, 2009. Submitted to CEC/Docket Unit on July 29, 2009.

CEC 2009j – California Energy Commission/C. Meyer (tn 53019). Energy Commission Staff's Status Report #1, dated August 27, 2009. Submitted to CEC/Docket Unit on August 27, 2009.

CEC 2009k – California Energy Commission/T. O'Brien (tn 53113). Data Response & Issues Resolution Workshop Notice, dated September 2, 2009. Submitted to CEC/Docket Unit on September 2, 2009.

CEC 2009l – California Energy Commission/C. Meyer (tn 54376). Memo to Applicant Regarding Transmission Line Upgrades, dated October 21, 2009. Submitted to CEC/Docket Unit on December 9, 2009.

CEC 2009m – California Energy Commission/C. Meyer (tn 53729). CEC and BLM Staff Data Requests Set 2, Part 1 (#s 128-141), dated October 22, 2009. Submitted to CEC/Docket Unit on October 22, 2009.

CEC 2009n – California Energy Commission/J. Boyd/J. Byron (tn 53807). Notice of Committee Conference, dated October 26, 2009. Submitted to CEC/Docket Unit on October 26, 2009.

CEC 2009o – California Energy Commission/C. Meyer (tn 53818). CEC and BLM Staff Status Report #2, dated October 27, 2009. Submitted to CEC/Docket Unit on October 27, 2009.

CEC 2009p – California Energy Commission/J. Boyd/J. Byron (tn 53998). Committee Order Granting Defenders of Wildlife's Petition to Intervene, dated November 5, 2009. Submitted to CEC/Docket Unit on

CEC 2009q – California Energy Commission/C. Holmes (tn 53995).Energy Commission Staff's Comments on Schedule, dated November 5, 2009. Submitted to CEC/Docket Unit on November 5, 2009.

CEC 2009r – California Energy Commission/J. Boyd/J. Byron (tn 54240). Revised Committee Scheduling Order, dated November 24, 2009. Submitted to CEC/Docket Unit on November 24, 2009.

CEC 2009s – California Energy Commission/K. Van Vorst (tn 54275). Letter of Deficiency Regarding Application for Confidential Designation, dated November 30, 2009. Submitted to CEC/Docket Unit on November 30, 2009.

CEC 2009t – California Energy Commission/K. Van Vorst (tn 54276). Letter of Deficiency Regarding Application for Confidential Designation, dated November 30, 2009. Submitted to CEC/Docket Unit on November 30, 2009.

CEC 2009u – California Energy Commission/C. Meyer (tn 54607). Energy Commission Staff's Status Report #3, dated December 29, 2009. Submitted to CEC/Docket Unit on December 29, 2009.

CEC 2010a – California Energy Commission/J. Boyd/J. Byron (tn 54802). Notice of Committee Conference, dated January 13, 2010. Submitted to CEC/Docket Unit on January 14, 2010.

CEC 2010b – California Energy Commission/C. Meyer (tn 54812). Energy Commission Staff's Status Report #4, dated January 14, 2010. Submitted to CEC/Docket Unit on January 14, 2010.

CEC 2010c – California Energy Commission/A. Eggert/J. Byron (tn 55115). Revised Committee Scheduling Order, dated February 2, 2010. Submitted to CEC/Docket Unit on February 2, 2010.

CEC 2010d – California Energy Commission/A. Eggert/J. Byron (tn 55332). Notice of Committee Conference, dated February 11, 2010. Submitted to CEC/Docket Unit on February 11, 2010.

CEC 2010e – CEC/Rose Mary Avalos (tn 55658). CD WebEx Recording of February 23rd Status Conference, dated February 23, 2010. Submitted to CEC/Docket Unit on February 25, 2010.

CEC 2010f – CEC/K. Van Vorst (tn 55651). Deficient Application for Confidential Designation Letter, date February 25, 2010. Submitted to CEC/Docket Unit on February 25, 2010.

CEC 2010g – CEC/P. Kramer (tn 55804). Hearing Officer's E-mail to Applicant Regarding Marked Up Project Scheduling Order, dated March 8, 2010. Submitted to CEC/Docket Unit on March 9, 2010.

CEC 2010h – CEC/C. Meyer (tn 55827). Energy Commission Staff's Status Report #5, dated March 10, 2010. Submitted to CEC/Docket Unit March 10, 2010.

DHS 1999 – California Department of Health Services, Division of Drinking Water and Environmental Management, 1999, Drinking Water Source Assessment and Protection, (DWSAP) Program, January 1999.

Durbin 2000 – Durbin T., 2000, Comments on Draft EIR/EIS Cadiz groundwater storage project Cadiz and Fenner Valleys, San Bernardino County, California: Prepared for County of San Bernardino, February 21, 2000.

DWR 1964 – California Department of Water Resources, 1964, Groundwater Occurrence and Quality Lahontan Region, Bulletin No. 106-1, June 1964.

DWR 1967 – California Department of Water Resources, 1967, Water Wells and Springs in Bristol, Broadwell, Cadiz, Danby and Lavic Valleys and Vicinity, Bulletin No. 91-14 August 1967.

Friewald 1984 – Friewald, D.A., 1984, Ground-water resources of Lanfair and Fenner Valleys and vicinity, San Bernardino County, California: U.S. Geological Survey Water Resources Investigation Report 83-4082.

Huitt-Zollars. Prepared for Stirling Energy Systems, Inc. *Existing Condition Hydrologic and Hydraulic Study for Solar One (Phase 1 and 2) Project Site*, Binders 1 and 2. April 23, 2009.

La Moreaux 1995 – La Moreaux and Associates, 1995, Technical comments on groundwater recharge and projected drawdown for Bristol-Cadiz Valley: La Moreaux and Associates, Tuscaloosa, AL.

Maxey and Eakin 1949 – Maxey, G.B., and T.E. Eakin, 1949, Ground water in White River Valley, White pine, Nye and Lincoln Counties Nevada: Nevada State Engineer, Water Resources Bulletin 8.

Metropolitan 1999a – Metropolitan Water District and Bureau of Land Management, 1999, Cadiz groundwater storage and dry-year supply program: Environmental Planning Technical Report, Groundwater Resources Volumes I and II. Report No.1163.

Metropolitan 1999b – Metropolitan Water District and Bureau of Land Management, 1999, Cadiz groundwater storage and dry-year supply program: Supplement to the Draft EIR/EIS Report No.1169.

Metropolitan 2001 – Metropolitan Water District and Bureau of Land Management, 2001, Final Environmental Impact Report/Final Environmental Impact Statement, Cadiz Groundwater Storage and Dry-Year Supply Program, San Bernardino, California.

Moyle 1967 – Moyle, W.R., 1967, Water Wells and Springs in Bristol, Broadwell, Cadiz, Danby and Lavic Valleys and Vicinity, San Bernardino and Riverside Counties, California: California Department of Water Resources Bulletin 91-14.

MWA 2009a – Mojave Water Agency/K. Brill (tn 53079). Mojave Water Agency's Comments on SES Solar One, dated August 27, 2009. Submitted to CEC/Docket Unit on August 31, 2009.

Rosen 1989 – Rosen, M.R., 1989, Sedimentologic, Geochemical and Hydrologic Evolution of an Intracontinental, Closed-Basin Playa (Bristol Dry Lake, CA): A Model for Playa Development and Its Implications for Paleoclimate, PhD Dissertation: Austin, University of Texas, 266 pp.

RWQCB 2005 – California Regional Water Quality Control Board – Lahontan Region. *Water Quality Control Plan for the Lahontan Region: North and South Basins*. As amended through December, 2005.

San Bernardino County. *Stormwater Pollution Prevention* website. http://www.sbcountystormwater.org/GenaralStormwaterInfo.html Accessed February 16, 2010.

SES 2008a – Stirling Energy Systems/R. Liden (tn 49181). Application for Certification, dated December 1, 2008. Submitted to CEC/Docket Unit on December 1, 2008.

SES 2009b – Stirling Energy Systems/C. Champion (tn 50880). Supplement to the Application for Certification, dated April 6, 2009. Submitted to CEC/Docket Unit on April 6, 2009.

SES 2009d – URS/C. Lytle (tn 51326). Revised Response to Staff's Solar One Data Adequacy Request Number 53. Submitted to CEC/Docket Unit on April 28, 2009.

SES 2009e – URS/B. Magdych (tn 51348). Response to Staff's Request for Additional Information, dated April 29, 2009. Submitted to CEC/Docket Unit on April 29, 2009.

SES 2009h – Stirling Energy Systems/C. Champion (tn 52457). Applicant's Responses to CURE's Data Requests Set 1, dated July 16, 2009. Submitted to CEC/Docket Unit on July 20, 2009.

SES 2009i – Stirling Energy Systems/C. Champion (tn 52466). Applicant's Responses to Energy Commission and Bureau of Land Management's Data Requests Set 1, Part 1, dated July 17, 2009. Submitted to CEC/Docket Unit on July 20, 2009.

SES 2009k – Stirling Energy Systems/C. Champion (tn 52468). Applicant's Report to Map Federal and State Surface Waters, dated July 17, 2009. Submitted to CEC/Docket Unit on July 20, 2009.

SES 2009m – URS/C. Lytle (tn 52599). Applicant's Response to CURE Data Requests, dated July 27, 2009. Submitted to CEC/Docket Unit on July 28, 2009.

SES 2009n – Stirling Energy Systems/F. Bellows (tn 52630). Applicant's Response to Public Comments for June 22 Informational Hearing and Site Visit, dated July 30, 2009. Submitted to CEC/Docket Unit on July 30, 2009.

SES 2009o – Stirling Energy Systems/C. Champion (tn 52877). Applicant's Response to CURE Data Requests Set 2 (Data Requests 229-275), dated August 13, 2009. Submitted to CEC/Docket Unit on August 17, 2009.

SES 2009p – Stirling Energy Systems/C. Champion (tn 52956). Applicants' Response to Energy Commission & Bureau of Land Management's Data Requests 113-127 of Data Requests Set 1, Part 2, dated August 20, 2009. Submitted to CEC/Docket Unit on August 24, 2009.

SES 2009r – Stirling Energy Systems/C. Champion (tn 53067). Applicant's Responses to Energy Commission & Bureau of Land Management's Data Request 1-91 of Data Request Set 1, Part 1, dated August 28, 2009. Submitted to CEC/Docket Unit on August 28, 2009.

SES 2009t – Stirling Energy Systems/C. Champion (tn 53093). Applicant's Responses to Energy Commission and Bureau of Land Management's Data Requests 1-48, 81, and 109-112 of Set 1 Parts 1 and 2, dated August 31, 2009. Submitted to CEC/Docket Unit August 31, 2009.

SES 2009u – Stirling Energy Systems/C. Champion (tn 53094). Applicant's Response to Energy Commission and Bureau of Land Management's Data Requests 81-Drainage, Erosion, and Sediment Control Plan, dated August 31, 2009. Submitted to CEC/Docket Unit on August 31, 2009.

SES 2009cc – Stirling Energy Systems/C. Champion (tn 54099). Applicant's Response to CURE Data Requests 276-380 of Set 3, dated November 12, 2009. Submitted to CEC/Docket Unit on November 13, 2009.

SES 2009dd – Stirling Energy Systems/F. Bellows (tn 54229). Applicants' Responses to Energy Commission & Bureau of Land Management's Data Request Set 1, Part 2 Cultural Resources Data Responses & 25% Submittal, dated November 19, 2009. Submitted to CEC/Docket Unit on November 20, 2009.

SES 2009ee – Stirling Energy Systems/C. Champion (tn 54272). Applicant's Response to Energy Commission & Bureau of Land Management's Data Requests Set 1, Part 1 & Set 2, Part 1 Data Requests 71-73, 76-79, 85 & 128-141, dated November 23, 2009. Submitted to CEC/Docket Unit on November 24, 2009.

SES 2009ff – Stirling Energy Systems/F. Bellows (tn 54322). Transcript from the September 16th Data Request & Issue Resolution Workshop, dated November 30, 2009. Submitted to CEC/Docket Unit on December 2, 2009.

SES 2009gg – URS/C. Lytle (tn 54352). Applicant's Response to CURE Data Requests Set 4, dated December 1, 2009. Submitted to CEC/Docket Unit on December 3, 2009.

SES 2009ii – Stirling Energy Systems/C. Champion (tn 54386). Applicant's Response to Energy Commission & Bureau of Land Management's Data Requests Set 2, dated December 4, 2009. Submitted to CEC/Docket Unit on December 4, 2009.

SES 2009jj – Stirling Energy Systems/F. Bellows (tn 54427). Applicant's Updated Project Map, dated December 10, 2009. Submitted to CEC/Docket Unit on December 14, 2009.

SES 2009mm – Stirling Energy Systems/C. Champion (tn 54580). Applicant's Letter Describing Project Updates, dated December 21, 2009. Submitted to CEC/Docket Unit on December 21, 2009.

SES 2010c – URS/C. Lytle (tn 54836). Applicant's Submittal of Additional Alternatives Analysis, dated January 7, 2010. Submitted to CEC/Docket Unit on January 7, 2010.

SES 2010d – URS/C. Lytle (tn 54738). Applicants Submittal of the Geotechnical Engineering Report, dated January 8, 2010. Submitted to CEC/Docket Unit on January 8, 2010.

Thompson 1929 – Thompson, D.G. 1929, The Mojave Desert Region, California: USGS Water Supply Paper 578, 795 pp.

TS 2010h – Tessera Solar/F. Bellows (tn 55391). Drainage Layout Figure, dated February 12, 2010. Submitted to CEC/Docket Unit on February 16, 2010.

TS 2010j – Tessera Solar/F. Bellows (tn 55663). Applicant's Responses to Energy Commission Data Requests Set 1 Part 2 – Data Requests 102 and 103, dated February 24, 2010. Submitted to CEC/Docket Unit on February 24, 2010.

TS 2010l – Tessera Solar/C. Champion (tn 55779). Information from Applicant Regarding Water & Waste, dated February 19, 2010. Submitted to CEC/Docket Unit on March 8, 2010.

TS 2010m – Tessera Solar/F. Bellows (tn 55802). Applicant's Application for Clean Water Act 401 Water Quality Certification and/or Waste Discharge Requirements & Submittal of Notification of Lake or Streambed Alteration, dated March 4, 2010. Submitted to CEC/Docket Unit on March 8, 2010.

TS 2010n – Tessera Solar/F. Bellows (tn 55823). Applicant's Submittal of the Revised Calico Solar Project Layout Figure, date March 8, 2010. Submitted to CEC/Docket Unit on March 10, 2010.

USGS 2000 – U.S. Geological Survey, 2000, Review of the Cadiz groundwater storage and dry-year supply program Draft Environmental Planning Technical Report, groundwater resources, volumes I and II, Memorandum from J. F. Devine (USGS) to M.S. Brady (Field Manager BLM, Needles, CA),February 23, 2000.

SOIL AND WATER RESOURCES – APPENDIX A
ACRONYMS USED
IN THE SOIL AND WATER RESOURCES SECTION

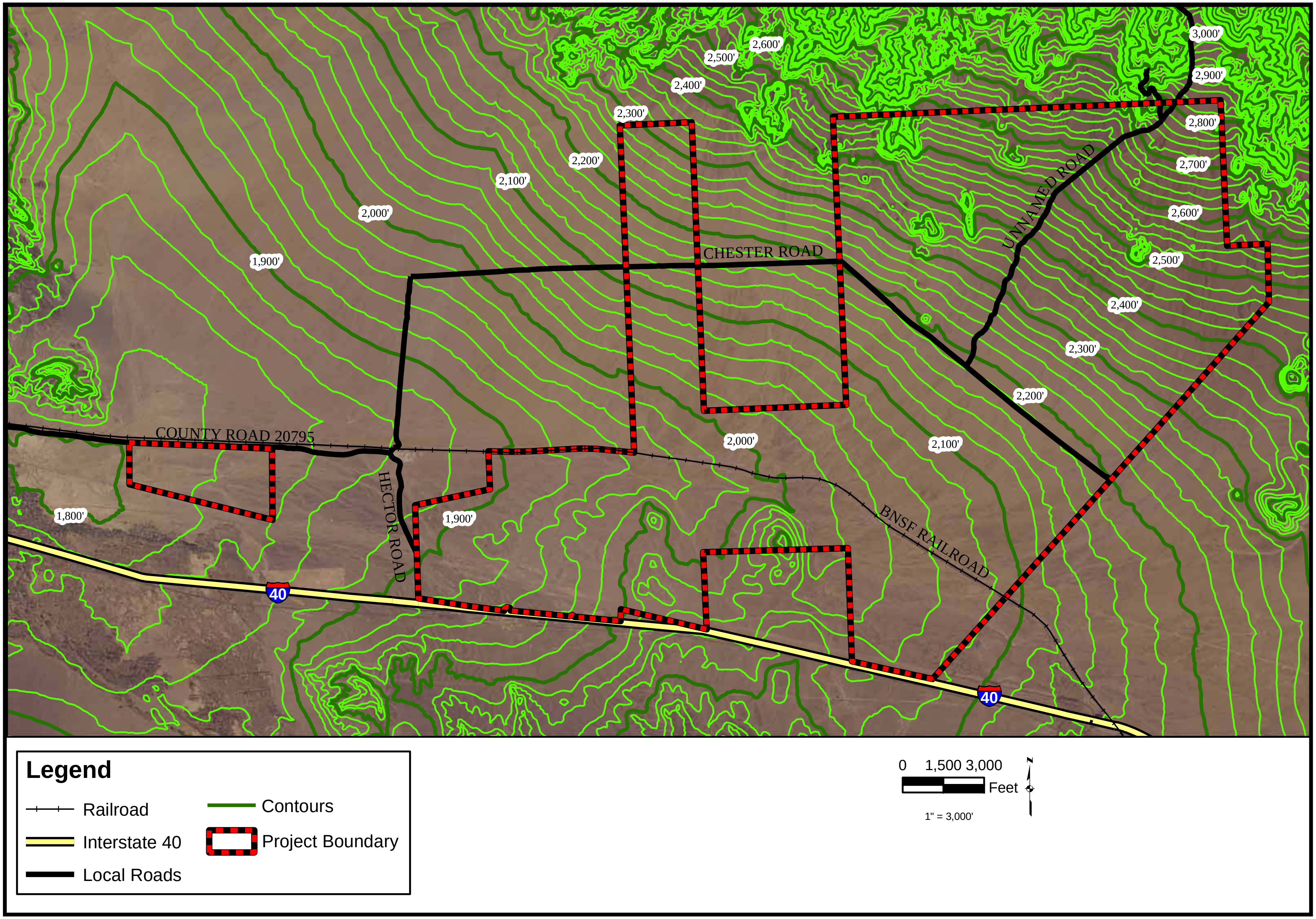
AF	acre-feet
AFY	acre-feet per year
BFE	Base Flood Elevation
BNSF	Burlington North Santa Fe
BMP	Best Management Practices
Caltrans	California Department of Transportation
CDFG	California Department of Fish and Game
CEQA	California Environmental Quality Act
cfs	cubic feet per second
CPM	Compliance Project Manager
CLOMR	Conditional Letter of Map Revision
CSDD	Capitol Storm Design Discharge
CVWD	Coachella Valley Water District
CWA	Clean Water Act
CWC	California Water Code
DESCP	Drainage, Erosion, and Sediment Control Plan
DFIRM	Digital Flood Insurance Rate Map
DTSC	Department of Toxic Substances Control
DWA	Desert Water Agency
DWR	Department of Water Resources
FEMA	Federal Emergency Management Agency
FIS	Flood Insurance Study
FIRMS	Flood Insurance Rate Maps
FSA	Final Staff Assessment
gpd	Gallons per day
gpm	gallons per minute
IEPR	Integrated Energy Policy Report
KCWA	Kern County Water Agency
LORS	laws, ordinances, regulations, and standards
mg/l	milligrams per liter
MW	megawatt
MWD	Metropolitan Water District of Southern California
NFIP	National Flood Insurance Program
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System

NRCS	National Resources Conservation Services
NWS	National Weather Service
NOAA	National Oceanic and Atmospheric Administration
Porter-Cologne	Porter-Cologne Water Quality Control Act
PSA	Preliminary Staff Assessment
RCRA	Resource Conservation and Recovery Act
RWQCB	Regional Water Quality Control Board
SFHA	Special Flood Hazard Area
SPRR	Southern Pacific Railroad
SSG	Solar Steam Generator
STG	Steam Turbine Generator
SWP	State Water Project
SWPPP	Storm Water Pollution Prevention Plan
SWRCB	State Water Resources Control Board
TDS	total dissolved solids
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
WQMP	Water Quality Management Plan
WSP	Water Supply Plan
WWTP	wastewater treatment plant
ZLD	zero liquid discharge

MARCH 2010

SOIL AND WATER RESOURCES - FIGURE 1

Calico Solar Project - Site Topography



SOIL AND WATER RESOURCES

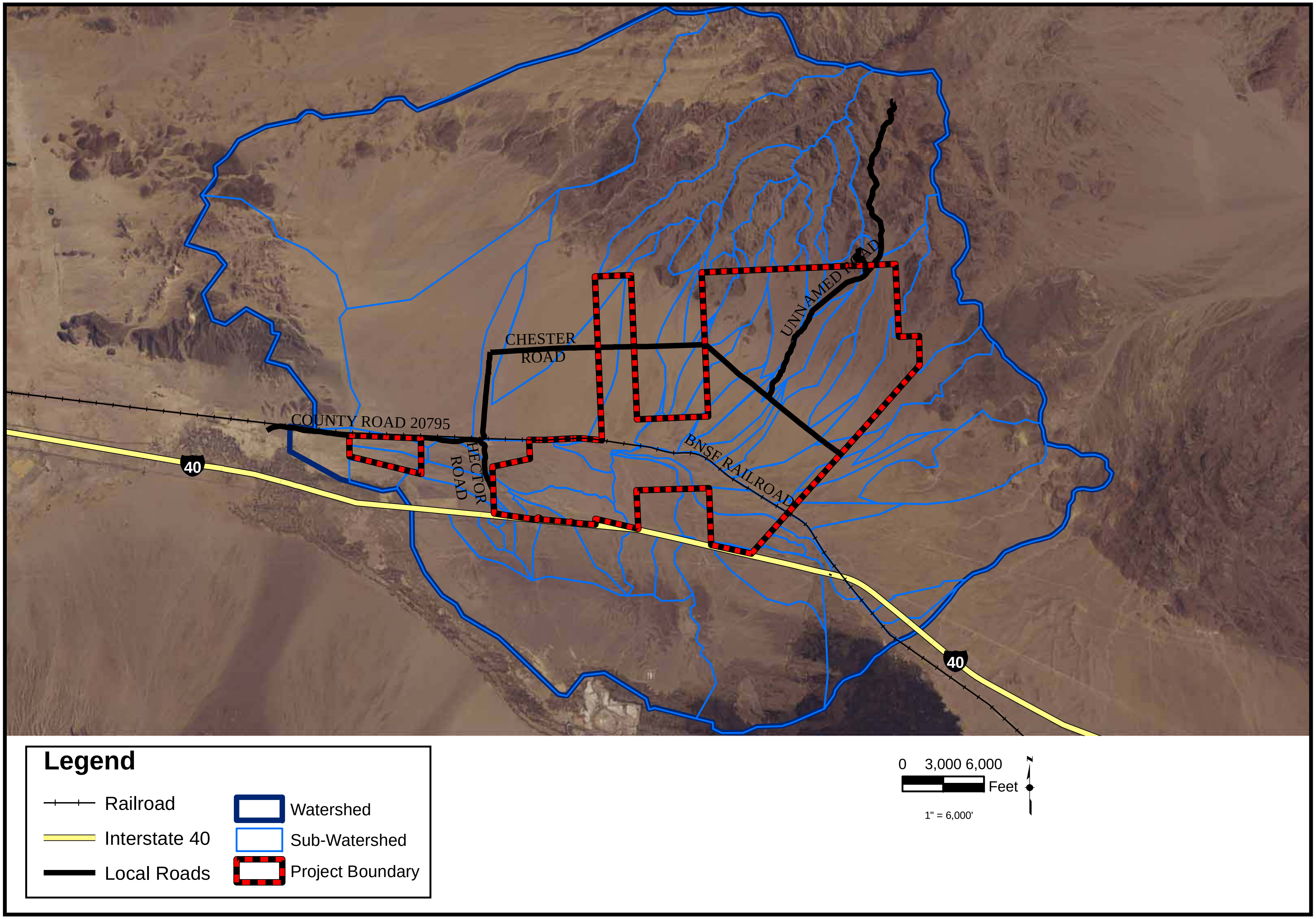
CALIFORNIA ENERGY COMMISSION - SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION, MARCH 2010

SOURCE: Winzler & Kelly

SOIL AND WATER RESOURCES - FIGURE 2

Calico Solar Project - Regional Watersheds

MARCH 2010



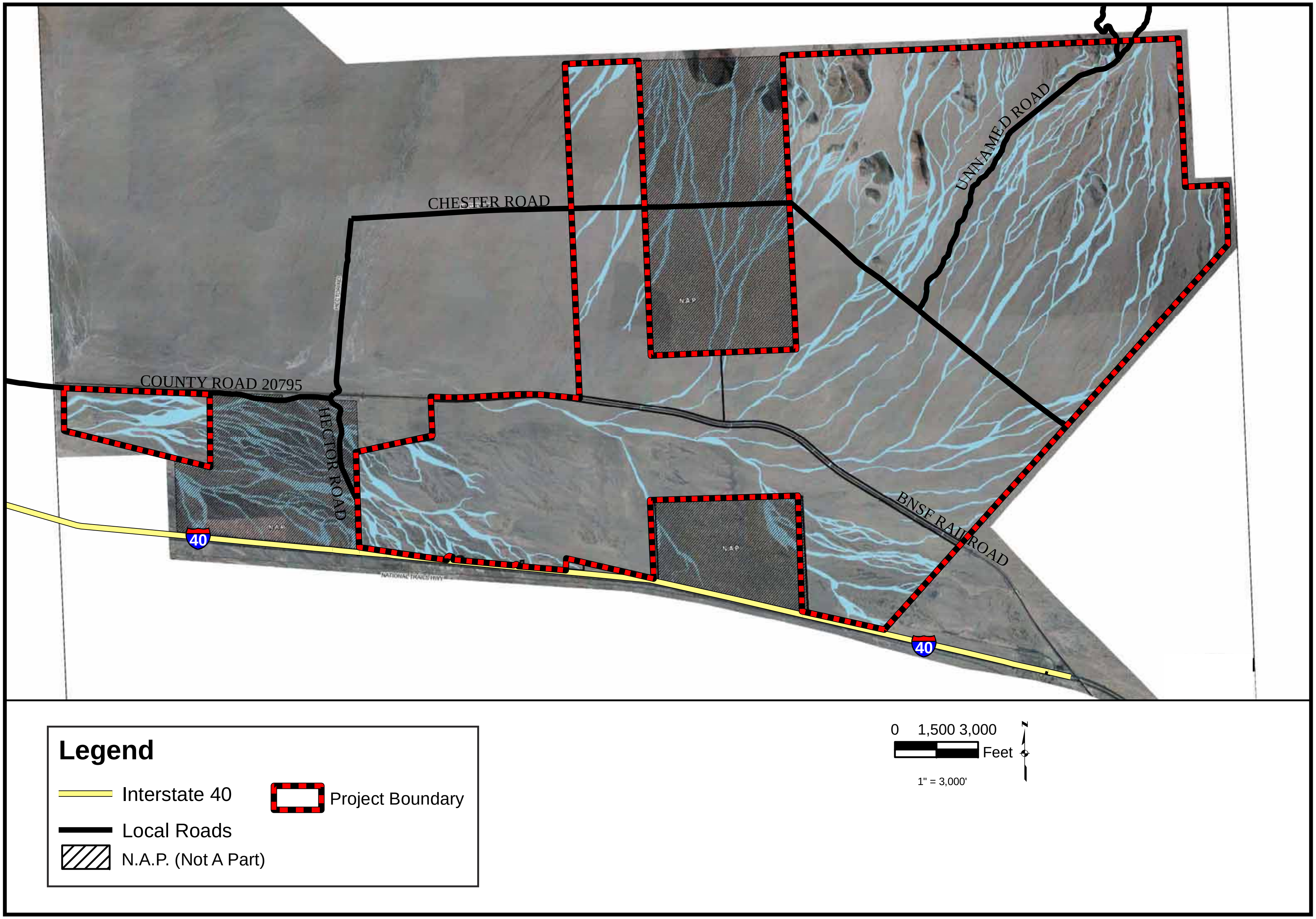
SOIL AND WATER RESOURCES

CALIFORNIA ENERGY COMMISSION - SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION, MARCH 2010

SOURCE: Winzler & Kelly, URS, 2008 and Huitt-Zolairs, 2009

SOIL AND WATER RESOURCES - FIGURE 3

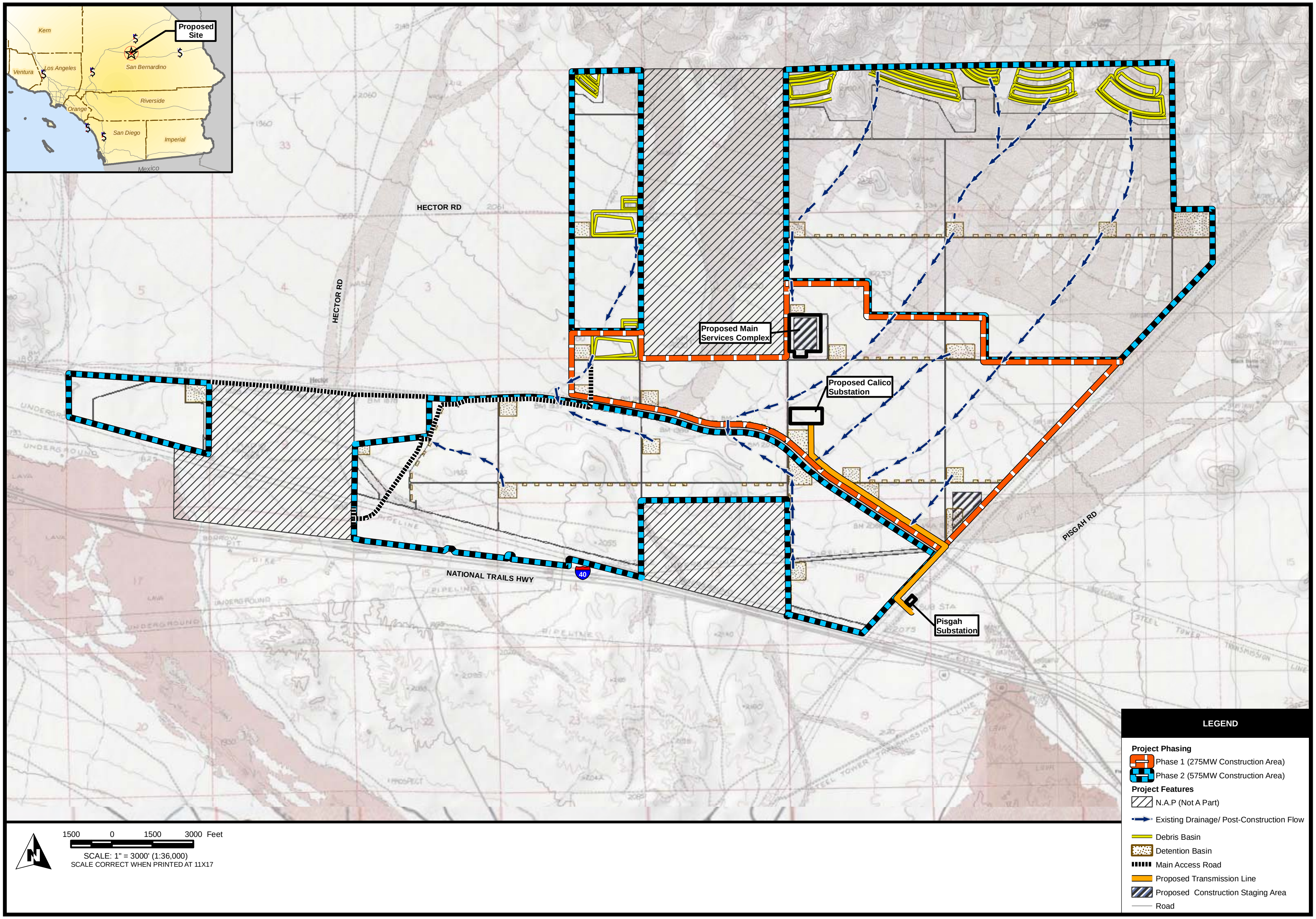
Calico Solar Project - Existing CDFG Flow Paths



SOURCE: Winzler & Kelly, URS 2010

SOIL AND WATER RESOURCES - FIGURE 4

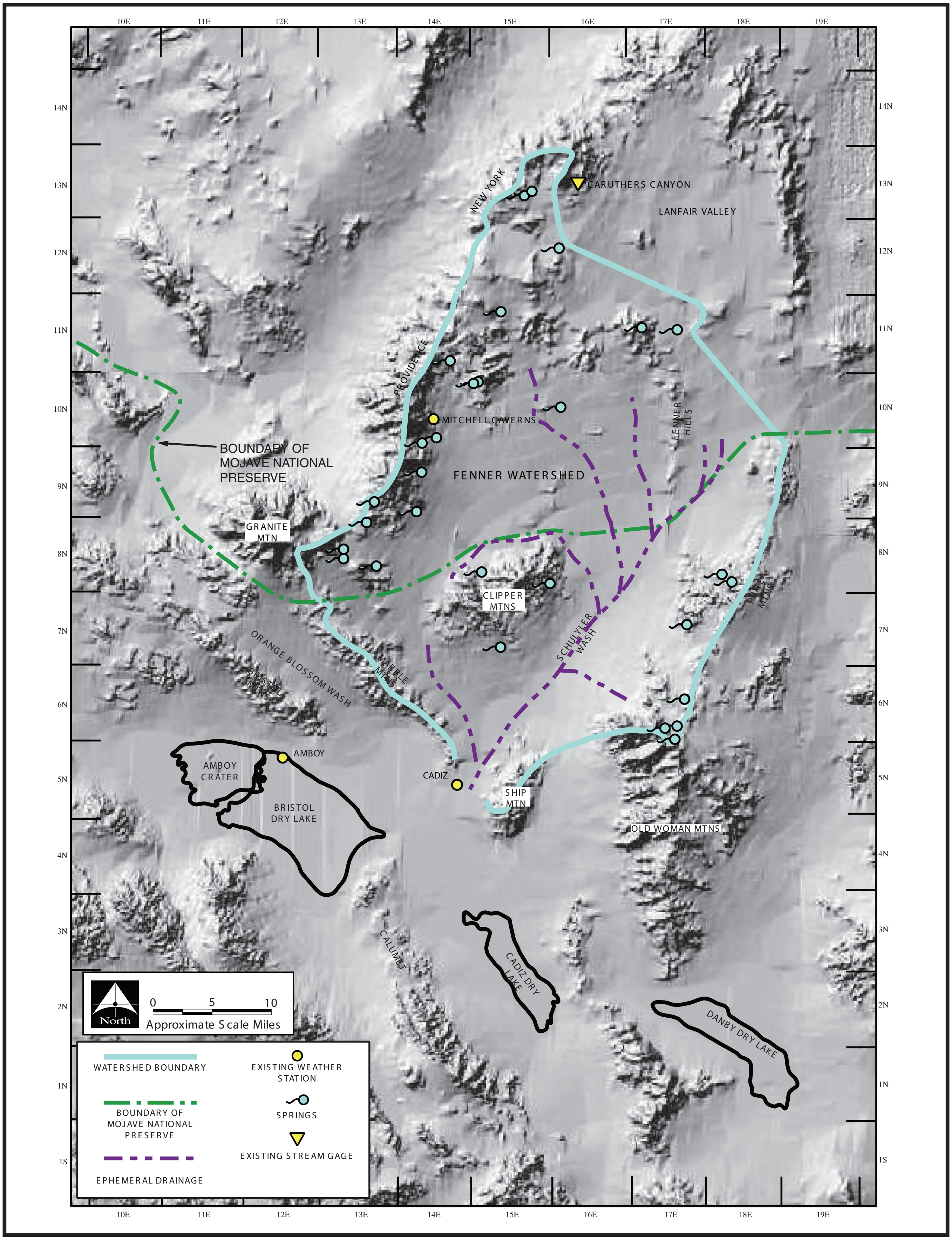
Calico Solar Project - Drainage Layout



CALIFORNIA ENERGY COMMISSION - SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION, MARCH 2010

SOURCE: URS, 2/11/2010

Calico Solar Project - Hydrologic Features in Water Supply Well Vicinity



CALIFORNIA ENERGY COMMISSION - SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION, MARCH 2010

SOURCE: FEIR/EIS, Cadiz Groundwater Storage & Dry-Year Supply Program, Figure 5.5-9